Railway Mechanical Engineer

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College men in the mechanical department

A college education is intended to train young men to think—to think straight—and to develop and strengthen their characters. The railroads need men who are trained to analyze problems and situations in order to determine the real facts, and on the basis of these to suggest remedies or solutions. Some of the more important industries have felt a pressing need for men who could function in this way and have been keen to recruit college-trained men. A very few railroads have made it a business to use college-trained men in the mechanical departments. Unfortunately, few of even these roads have done much to studying the situation scientifically and, after securing college-trained men, to see that they have been developed and utilized to the best advantage. Many railroads make absolutely no effort to attract college men to the service. To a large extent the railroads have handled this problem in a hit-and-miss way and have "muddled" through it. Something should be done to get the railroad representatives and the college professors together to make a very much needed survey and analysis of this situation and to recommend a policy which will more adequately meet the needs. There has been a lot of talk about this question, but too much of it has been in the way of generalities and opinions. What is needed now is some real scientific research and analysis.

Specialization of car repairs

An outstanding example of specialization in freight car heavy repair work is to be found at the Enola car shops of the Pennsylvania at Harrisburg, Pa., the operations of which are described on another page in this issue. At the present time this shop is rebuilding open-top cars of only two classes and at no time has it handled repairs to any but open-top equipment. The opportunities for the development and the installation of special equipment, which tends greatly to increase the productive efficiency of the plant and its personnel, which are offered by this specialization on a limited number of types in large runs, will impress the reader as he studies this article. When methods such as those adopted by the Pennsylvania, however, are suggested as of possible value on smaller systems, with perhaps considerably smaller numbers of cars of similar design, the answer very frequently is "That is all right for a large road, but our road is too small for any such methods." The possibilities of specialization are, of course, much greater on a system of large mileage with large numbers of cars of like design than on smaller railroads. Some of these possibilities, however, are available to every railroad maintaining more than one shop point for making heavy repairs to freight cars and the possibilities for specialization increase with each added heavy repair shop. Indeed, the possibilities are not entirely absent even where only one shop is available with which to work, as a reasonable amount of planning may make it possible to concentrate on rebuilding different series of equipment at different periods. Specialization requires planning. No matter how much local conditions may effect the extent and nature of the final plan, the adoption of some plan for systematic handling of any heavy freight car repair work places the car department officer in control of conditions which otherwise would control him. Only to the extent that he is master of his operations can their efficiency be assured.

What about engine truck lubrication?

Reports, received from numerous sources, indicate that trouble is being experienced in lubricating engine truck bearings, particularly where the locomotive runs have been extended over a number of divisions. The facts of the matter seem to be that the engine truck journals develop high temperatures and that no use of free oil admitted to the journals through the oil holes customarily provided in engine truck boxes seems to help the situation. It has been noticed that the oil apparently leaves the dope in the journal box cellars faster than can be accounted for either by evaporation or leakage at the ends of the cellars, and it is later found distributed well over the engine truck frame with the probability that still more of it is lost to the roadway and track. The normal movement of the oil seems in this case to be reversed due to some sort of a syphoning action, and, the more oil applied to the dope or as free oil, the more there is spread over the engine truck frame. The *Railway Mechanical Engineer* will be glad to publish the views of any of its readers as to the cause of this difficulty in lubricating engine trucks. Explanations of how the difficulty has been overcome will be particularly welcome.

The new labor bill

The past few years have witnessed a marked change on the railroads in the spirit of the relations between the managements and the employees—a change for the good which is little less than remarkable. There are many people who object strongly to the use of the word "co-operation," because it has been abused and misused to such an extent as to have lost much of its meaning in a big, forceful, constructive way. Nevertheless, a real spirit of co-operation in its better and higher sense has found its way into railway organizations, as well as into many of the industries. There are a variety of reasons for this and it may be worth while to consider a few of them.

The world war and the difficult and confusing period which followed it, caused great apprehension as to future developments in the industrial and transportation world,

as well as in our political and social structures. This forced people to think and to make a greater effort to get below the surface and determine the real facts about the situation. Naturally, there is still much loose thinking of the soap-box orator type, but, nevertheless, the average man today is not nearly as susceptible to such appeals as in former years. For one thing, Americanization and citizenship programs have been more actively promoted. Immigration has been restricted and more intelligent attention has been given to the assimilation of the foreign element.

The question of government ownership of the railways, precipitated by the taking over of the railroads by the government during the war and the discussion of ways and means to transfer the roads back to their owners, caused the general public to analyze, if only in a general way, the functioning of the railroads and the vital part which they play in the public welfare. The railway managements, seriously concerned over the outcome, threw themselves into an educational campaign which reached the employees as well as the general public, and dissipated many misunderstandings as the facts about railway management and operation became more widely known and better understood. The shippers saw clearly what unintelligent regulation of the carriers could do in handicapping railway operation, and alarmed at this, went even further, and have shown a cordial and even enthusiastic spirit of constructive co-operation, which has made possible a far greater degree of efficiency in utilizing the railway facilities.

Industrial leaders a few years ago began to awaken to the fact that industries had grown so fast—and the railways likewise—that they had far outstripped improvements in methods of management. For one thing, no adequate plan had been devised to provide for the right kind of leadership and to develop and train the great number of officers, supervisors and foremen which were required. While much still remains to be done in this respect, a start has been made, small as it may be. Even this slight advance has been reflected in the better relations between the workers and the managements.

The Railroad Y. M. C. A. took an advance position two and a half years ago in converting its triennial international conference into a better relations conference, and this has been followed up by a large number of system and local get-together or better relations meetings. A number of roads have inaugurated various types of what might be called personnel activities, extending all the way from the formal organization of a personnel department to the limited application of personnel work in certain specific departments. The formation of supervisors and foremen's clubs and training classes has been speeded up during the past season.

These are only a few of the things that apparently have developed a spirit of co-operation and understanding, which made possible the joining of the railway managements and representatives of the workers in suggesting a labor bill to Congress, which will abolish the present Railway Labor Board and establish machinery for adjusting misunderstandings and disputes.

A summary of the important principles involved in the bill will be found in the news section. Hearings are now being held before a Senate committee in Washington. Naturally both sides had to give up something in agreeing upon this bill and because of these understandings Congress is being asked to pass the bill just as it has been presented. A representative of a manufacturers' organization has asked that certain changes be made in the bill because he believes that it does not adequately protect the public interest. While there may be some merit to his criticisms, it must be remembered that, after all, the important thing in making the bill effective will be the spirit in which the parties attempt to carry out its provisions. Apparently there is now an excellent spirit of co-operation on the part of the managements and men, and this means far more in the interests of all concerned, including the public, than a bill which might look better on paper, but was not fully endorsed or concurred in by the managements and the men. It is quite probable that Congress, recognizing this, will keep its hands off and put it squarely up to the railroads and the employees to abide by the law, when enacted, in the spirit in which they entered into the agreement to recommend it to Congress.

Fuel records and road foremen

The most favorable records in operating efficiency during 1925 were made in gross ton-miles per train hour and gross tons per train but the fuel performance expressed in pounds per thousand gross ton-miles was a close third, showing a decrease of 6.6 per cent in the first ten months of 1925 as compared to a similar period in 1924, and 14.2 per cent over the first ten months of 1923. The intensive effort which many of the railroads have been making to cultivate among employees of all classes a knowledge of how to save fuel and a desire to accomplish this end are thus shown to be bearing valuable fruit. It is readily possible to compute the actual saving in dollars which this reduction in fuel consumption makes possible.

Engine crews cannot be given all of the credit for good locomotive fuel performance, nor should they receive all the blame when the fuel consumption figures are higher than seem to be desirable or necessary. It is self-evident, however, that engine crews are one of the most important factors in the situation and the fact that a steady reduction in the fuel consumption per thousand gross ton-miles is being made proves that the crews are measuring up to their task in no uncertain way. A master mechanic recently reported, "It might interest you to know that frequently I have an engineer call on me, advising that he has hauled 1,600 tons from a given point to V——— with six tons of coal, and asking if I will not figure out the pounds of coal per thousand gross ton miles, as he thinks that he has established a record." Such an attitude as this is impossible unless engine crews feel that they are being treated fairly and are proud of the roads they work for. Master mechanics and road foremen are largely responsible for the morale of the crews.

The idea of competition in fuel performance between divisions and between individual engine crews having comparable runs on the same division may well be encouraged, for it adds greatly to that interest which must be kept fully alive in order to accomplish the best results in fuel economy. The need of close co-operation between both sides of the cab should also be emphasized, for unless both enginemen and firemen study the action of the locomotive on the fire under various operating conditions, fuel will be wasted and tempers tried. Minor defects should be discovered and corrected before they have a chance to develop into something serious and with both the enginemen and firemen working together in harmony the chances of these defects being overlooked are minimized.

That improvements in the method of operating locomotives are still necessary is shown by the following comment of another master mechanic, "There are too many men operating locomotives upon the theory of 'a big locomotive a big noise.' The engineman that creates the biggest noise at the stack is usually anything but successful, and his failure is bound to be detrimental to the general condition and efficiency of the locomotive." The impor-

tance of road foremen in educational and morale building efforts among the engine crews cannot be over-estimated and there is little question that some roads are at the present time operating with too small a force of this important class of supervisor. In general the limits at the present time are about 40 to 100 locomotives per road foreman. Obviously if the railroads which give one road foreman 40 locomotives to look out for are right, the other roads which make a road foreman responsible for 100 locomotives and the crews necessary for their operation are scattering the efforts of this man too widely for his work to be effective.

Savings on repair costs

A correspondent writing on the subject of "Savings on repair costs," said, in a letter published in the January *Railway Mechanical Engineer,* that: "Locomotives are carded in the shop, needing, let us say, a new cylinder, when the parts needed are not on hand. This locomotive cannot be built in the proper time on account of the missing material. . . . The essential contributing factor to such a situation is that locomotives do not receive the proper inspection before coming to the shop with the result that defective parts are not located until the engine is in the shop and stripped.

"Again, under the present methods of accounting, men must charge out their time against some locomotive. As a result of this practice, a locomotive that is in the shop a long time receives an incorrect labor charge, due to the men becoming too familiar with the engine number. To remedy these conditions, I would suggest that a thorough inspection be made of a locomotive about due for the shop and the standard defective parts noted. The report should be forwarded to the shop which is scheduled to make the repairs; the parts obtained and machined as far as possible ready to apply, before the locomotive is ordered in. The locomotive could then be rebuilt rapidly and the time out of service greatly reduced."

This correspondent who signs himself "Schedule Supervisor" has evidently, in the study of his job, come in close contact with one of the factors which tends to disrupt the otherwise smooth operation of a well organized scheduling system, namely; delays due to shortage of material. Primarily, scheduling systems have been introduced to facilitate shop output, but if the possibilities of utilizing them as indicators of future requirements have not been considered, then they have failed to serve their full purpose.

Within the past two years remarkable strides have been made in the development of scheduling systems and in almost every large shop that has installed some form of system one of the outstanding facts has been that the routine operation of such a system has made it necessary to not only know in advance what work is to be done, but what material will be needed to perform that work. Drawing on the experience of one road which has been especially successful in the development of its scheduling system, it may be of interest to comment on the fact that the advisability of establishing close contact between the mechanical and the stores departments soon became apparent. To attain this contact, one man has been assigned to devote his entire time to following up material requirements. He has simplified his work to a great extent by analyzing daily the copies of locomotive work reports which are furnished him from divisional engine terminals. In this way he is continually informed of all defects of any parts on a locomotive which may eventually go to that shop for repairs. The defect is immediately investigated to determine whether or not the part can be repaired or a new part will be required. It may readily be determined about how long it will be before that locomotive is due to be shopped and with this advance notice of material required, there should be no excuse for a shortage of material existing when the locomotive is finally taken into the shop for repairs.

A lack of co-operation between the mechanical and stores departments may be the source of great loss. Possibly one of the reasons, in many cases, why a stores department falls down when it comes to supplying material when most needed is because the mechanical department has failed to furnish proper information far enough in advance of the time that the material is needed to afford the stores department an opportunity to secure it.

New Books

THE MAKING, SHAPING AND TREATING OF STEEL. *By J. M. Camp and C. B. Francis. Published by the Carnegie Steel Co., Bureau of Instruction, Pittsburgh, Pa. Flexible binding, thin bible paper, fabricoid cover, 5 in. by 7¾ in.* 1194 *pages,* 346 *illustrations,* 104 *tables. Price* $7.50.

This is the fourth edition of this book within six years, and is virtually a new work on the metallurgy of iron and steel. While the previous editions were written mainly as a text and reference book for employees of the Carnegie Steel Company, this edition has been expanded to meet the needs of all the subsidiary companies of the United States Steel Corporation, not only as a text book for use in the various schools conducted by these companies but also as a reference book for their employees. In the work of composition and revision, the authors have kept in mind the needs of the customers of these companies and the schools and colleges throughout the country, among the latter of whom the previous editions have been used to a considerable extent. Consequently, in addition to revising the old text, there has been added much new matter, making the present volume about twice the size of the preceding edition. The book now covers the metallurgy of pig iron, wrought iron, and all kinds of wrought steel, from the mining of the ore and other raw materials to the finished products ready for fabrication, including tool steels, wire, sheets and tubes.

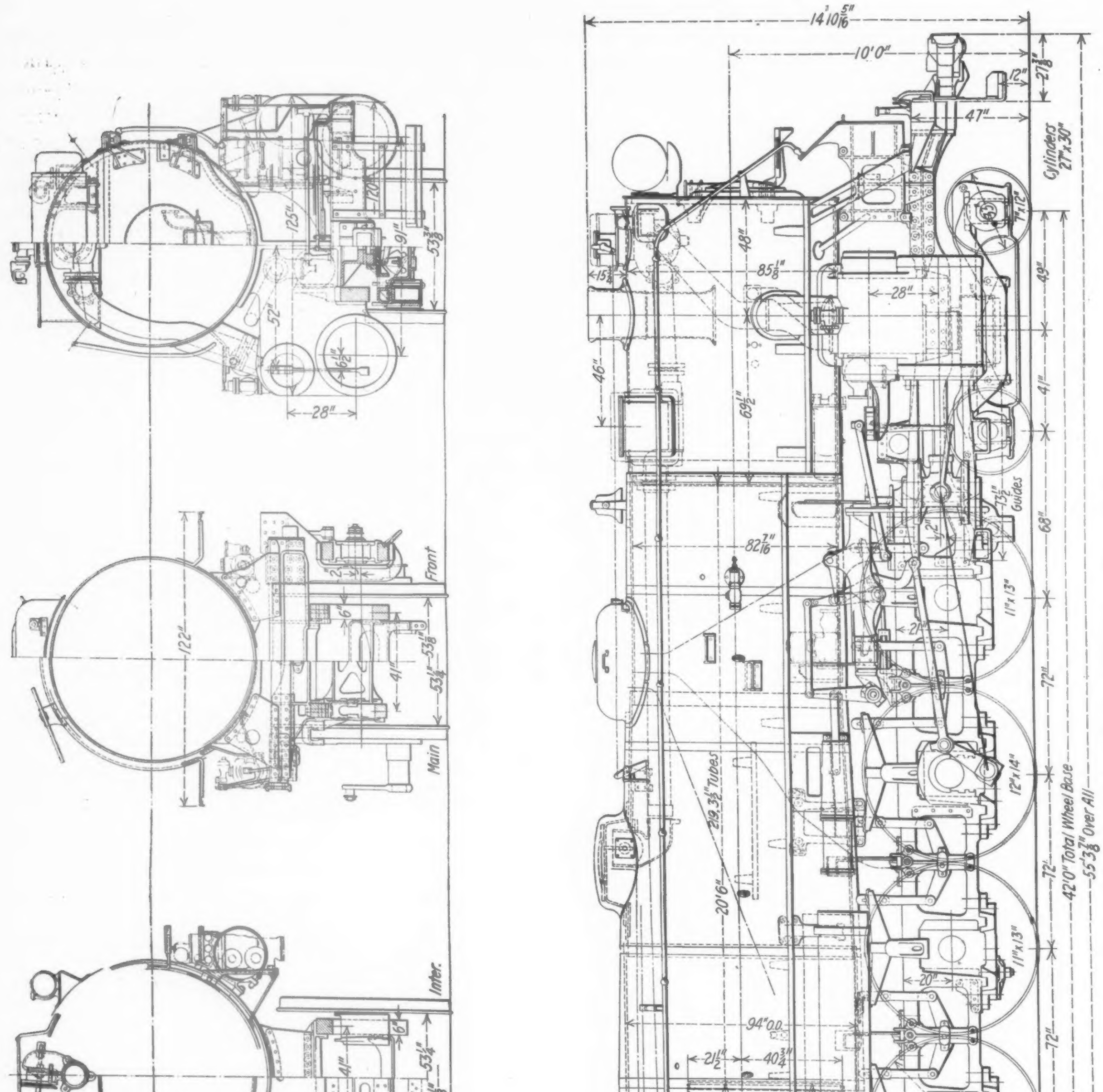
The book is divided into four parts. The first part includes 12 chapters under the general head of The Making of Steel. The new subjects added to Part One in this edition are chapters on The Manufacture of Wrought Iron, the Early Methods of Making Steel and an additional discussion on the acid open hearth process which was added to the chapter entitled, The Open Hearth Processes. Parts of other chapters have been entirely rewritten.

Part Two is entitled The Shaping of Steel and contains a total of 11 chapters. New material on pulverized coal, the by-product process of manufacturing coke, the benzol plant, and the classification of products of ferrous metallurgy, have been added to this part of the book.

"The Constitution, Heat Treatment and Composition of Steel" is the subject of Part Three which contains five chapters. Three new sections have been added to the chapter on Structural Alloy Steels and the last chapter is also a new addition to the book. The sections on Hardening and Tempering in the chapter on Heat Treatment have been entirely rewritten.

Part Four is devoted to The Manufacture of Steel Wire, Sheet and Tubular Products. It contains five chapters, the last chapter of which, on The Manufacture of Steel Tubular Products, is new.

The arrangement of the book makes it a convenient text for either teaching, general reading or reference.



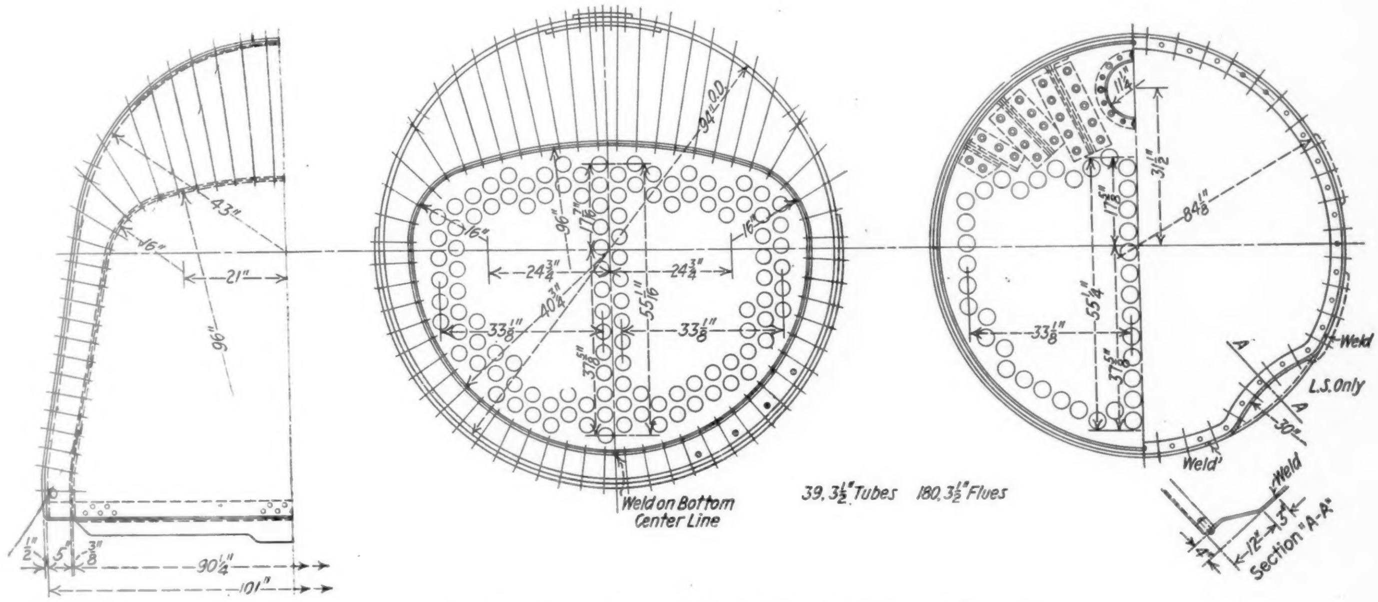
Elevation and cross-section drawings of New York Central locomotive No. 2700

New York Central buys 4-8-2 type locomotives

Location of accessories and construction of engine truck obtain better distribution of weight—Designed for high capacity

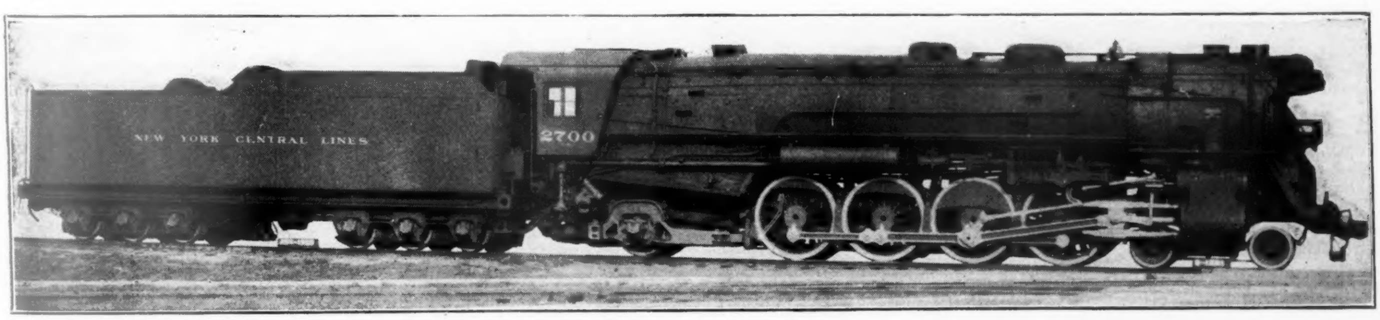
DURING the past ten months the new York Central has been operating a 4-8-2 type locomotive, built by the American Locomotive Company, in heavy freight service over the Mohawk division between the Selkirk engine terminal, near Albany, N. Y., and the Minoa terminal, located about eight miles east of Syracuse, N. Y. This division is a low grade line, the traffic requirements being such as to demand a locomotive that will maintain a high sustained tractive force at speeds. To meet these conditions locomotive No. 2700 was designed to handle maximum trains over this division at speeds corresponding to traffic requirements. No restrictions were placed by the railroad on the builders in the design of this locomotive, except to use as many New York Central standards as possible and to conform to certain axle loads.

The required maximum sustained horsepower was obtained by the use of a boiler having ample proportions, a firebox of ample heating surface and volume, and the application of the latest design of feedwater heater and superheater, together with the application of a stoker. Driving wheels 69 in. in diameter were used instead of 63 in., as commonly used in freight service, with a view to better meet the requirements of a river grade line. As a result of the performance of locomotive No. 2700, 99 locomotives of similar design have been ordered, making a total of 100 of this type, which will eventually be placed in operation on the New York Central system.



Cross section drawings of the boiler of the 4-8-2 type locomotive

One of the problems in the design of modern locomotives is to secure a satisfactory distribution of the weight over the engine wheel base. Locomotive No. 2700 is equipped with an Elvin stoker and a trailer booster. The location of the Elesco feedwater heater in its customary place on the smokebox front in a measure tends to balance the concentration of weight at the rear end. The location of the two cross-compound air compressors in front of the cylinders and the front end throttle, which is located



Locomotive of the 4-8-2 type built for the New York Central by the American Locomotive Company

in front of the stack, are further aids in improving weight distribution.

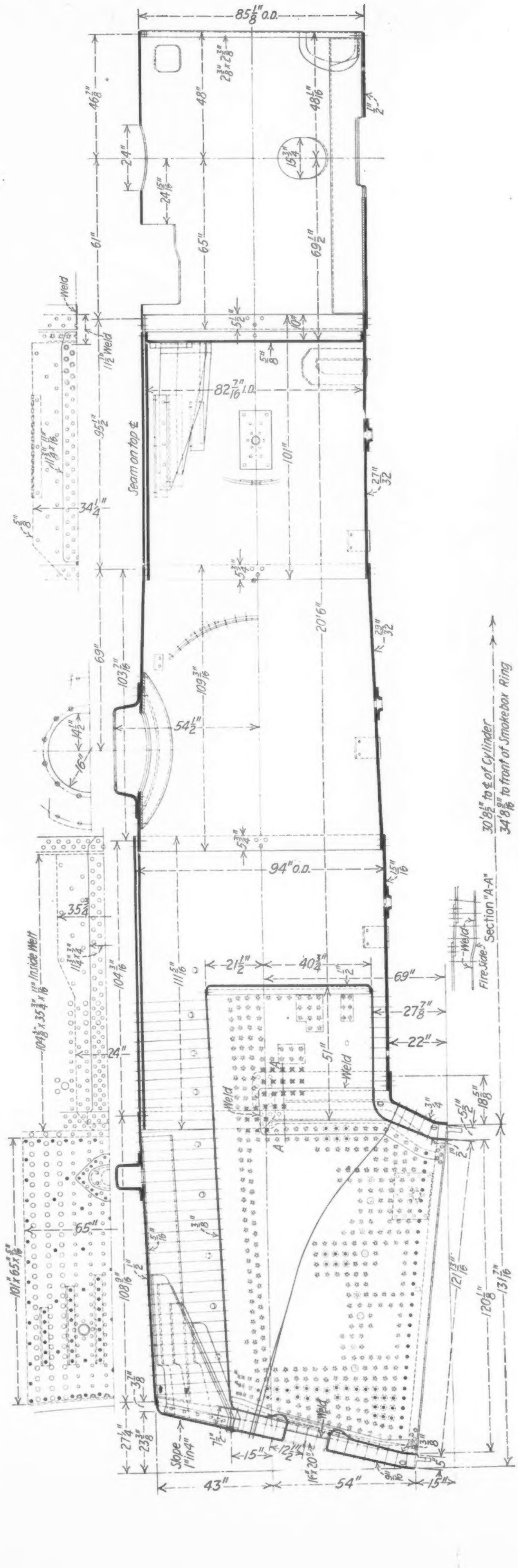
The designers have also assisted in obtaining a more satisfactory weight distribution through the construction of the engine truck. Referring to the elevation drawing, the reader will note that the truck center pin is 2 in. in the rear of the center line of the trucks and also that it is 6 in. back of the transverse center of the cylinders. This arrangement places a greater weight on the rear engine truck wheels than on the front which facilitates the guiding action of the truck and also shifts a greater proportion of the total weight of the engine onto the truck itself.

As shown in the table, these locomotives develop a rated tractive force of 60,000 lb. without the booster. With the booster an additional tractive force of 12,700 lb. is acquired, making a total of 72,700 lb. The total weight of these locomotives is 359,000 lb., of which 240,500 lb. is carried on the drivers, 58,000 lb. on the trailing truck and 60,500 lb. on the engine truck.

The boiler of these locomotives is of conical construction. As stated in a preceding paragraph, the design is of ample proportions which is an important factor in the increased capacity of these locomotives. The area of the grate is 75.3 sq. ft. The heating surface of the firebox and combustion chamber is 320 sq. ft. and the total evaporative heating surface of the boiler is 4,451 sq. ft. The boiler is equipped with a Type E superheater. The total

Principal dimensions, weights and proportions of the New York Central 4-8-2 locomotive

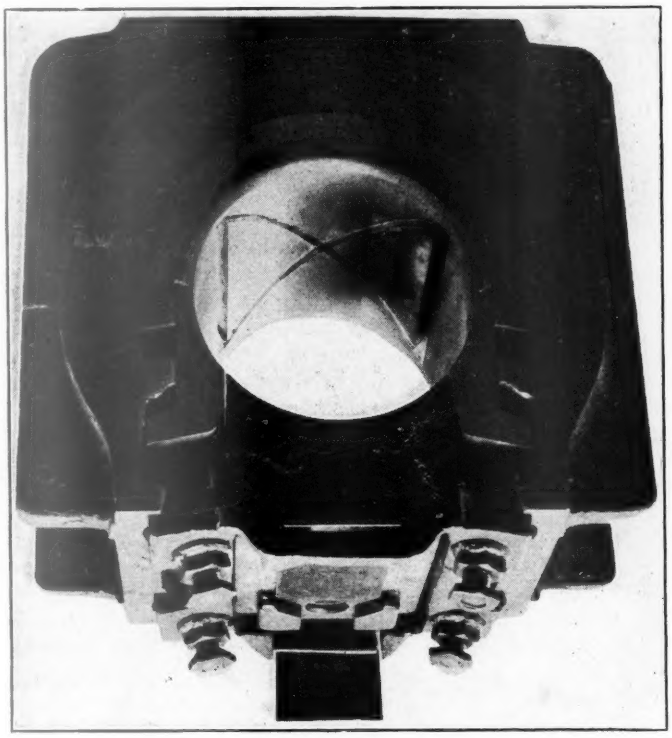
Railroad	New York Central
Builder	American Locomotive Company
Type of locomotive	4-8-2
Service	Fast freight
Cylinders, diameter and stroke	27 in. by 30 in.
Valve gear, type	Baker
Valves, piston type, size	14 in.
Maximum travel	9 in.
Outside lap	1 9/16 in.
Exhaust clearance	0 in.
Lead in full gear, constant	5/16 in.
Weights in working order:	
On drivers	240,500 lb.
On front truck	60,500 lb.
On trailing truck	58,000 lb.
Total engine	359,000 lb.
Tenders	275,000 lb.
Wheel bases:	
Driving	18 ft. 0 in.
Total engine	42 ft. 0 in.
Total engine and tender	84 ft. 7 in.
Wheels, diameter outside tires:	
Driving	69 in.
On front truck	33 in.
Trailing truck	44 in.
Boiler:	
Type	Conical
Steam pressure	225 lb.
Fuel, kind	Bituminous
Diameter, first ring, inside	82 7/16 in.
Firebox, length and width	120 1/8 in. by 90 1/4 in.
Combustion chamber, length	51 in.
Tubes, number and diameter	39-3 1/2 in.
Flues, number and diameter	180-3 1/2 in.
Length over tube sheets	20 ft. 6 in.
Grate area	75.3 sq. ft.
Heating surfaces:	
Firebox and comb. chamber	320 sq. ft.
Arch tubes	36 sq. ft.
Tubes and flues	4,095 sq. ft.
Total evaporative	4,451 sq. ft.
Superheating	1,985 sq.ft.
Comb. evaporative and superheating	6,436 sq. ft.
Tender:	
Water capacity	15,000 gals.
Fuel capacity	18 tons
General data estimated:	
Rated tractive force, 85 per cent	60,000 lb.
Rated tractive force, with booster	72,700 lb.
Cylinder horsepower (Cole)	3,640 hp.
Weight proportions:	
Weight on drivers ÷ total weight engine, per cent	67
Weight on drivers ÷ tractive force	4.02
Total weight engine ÷ comb. heat. surface	55.8
Boiler proportions:	
Tractive force × dia. drivers ÷ comb. heat. surface	645
Firebox heat. surface ÷ grate area	4.25
Firebox heat. surface, per cent of evap. heating surface	7.18
Superheat. surface, per cent of evap. heating surface	4.45



Elevation drawing of the boiler of the New York Central 4-8-2 type locomotive

superheating surface is 1,985 sq. ft., making a total combined evaporative and superheating surface of 6,436 sq. ft. Ready access to the unit bolts of the superheater is provided by a manhole located at the rear of the stack as shown in the elevation drawing. All the flues are of cold drawn, seamless steel, of which there are a total of 219, all $3\frac{1}{2}$ in. in diameter. The pipes from the feedwater heater are placed inside the smokebox which secures a better exterior appearance without greatly lessening the accessibility via the smokebox door.

The cylinders are of cast steel, the use of which material reduces the weight by 2,500 lb. The diameter is 27 in. and the stroke is 30 in. The design of these cylinders follows the usual conventional style of cast iron construction. The valves are of the piston type, size 14 in. and have a maximum travel of 9 in. They are actuated by a Baker valve gear, arranged to give a maximum cutoff of from 82 per cent to 84 per cent. This cutoff has been found to give the most satisfactory results at the relatively high speeds at which this locomotive is operated. The



View of main driving box equipped with supplemental bearings

locomotive is equipped with a single exhaust pipe having a $7\frac{1}{4}$-in. nozzle.

The main driving boxes are equipped with supplemental bearings designed for use on high powered locomotives. An idea of the construction of the boxes can be obtained by referring to the view shown in one of the illustrations. This type of main driving box was originally developed to withstand the severe service encountered in locomotives of three-cylinder design. It will be noted that additional bearing surface is provided below the center line of the journal which tends to eliminate excessive wear at the bottom edges of bearings of the ordinary type used on locomotives.

This engine is equipped with the standard New York Central 12-wheel tender. It has a Commonwealth cast steel frame and six-wheel trucks, equipped with clasp brakes. The tender is also provided with a water scoop in accordance with New York Central practice. The tank is of the water leg type having a capacity of 15,000 gal. of water and 18 tons of coal.

The foreman's job*

By F. M. A'Hearn

Greenville, Pa.

PROBABLY no better understanding can be gained of what the job of a railway shop foreman really is than by reference to our school dictionary where we find that among other definitions of the word foreman, the expression "the chief man." Assuming that the foreman is the *chief man*, it follows that he will of necessity possess certain characteristics that enable him to assume and maintain successful leadership.

Observing the conduct of a successful leader or foreman we see among other personal characteristics honesty, a broad-minded attitude, responsibility, originality, a progressive spirit, and last, but not least, an equal willingness to receive or to give orders or instructions.

The foreman in addition to passing judgment on the work of the mechanics, which requires the use of his own experience gained as a workman, is further trusted with something more important than skill or trade knowledge. He is given authority. No arbitrary time can be set in which a foreman shall learn the proper use of the authority given him. While some men make excellent supervisors from the beginning, others do not do so well. An unjust or incompetent foreman by misusing his authority can undo the efforts of the employer who seeks to promote the contentment and welfare of employees.

New type of foreman

Leadership excepted, the duties of the foreman of today are as unlike those of the past generation as are the tasks of the workman. Such things as pneumatic or electric tools, high speed steel, and the cutting torch, have made no greater change in the work of the mechanic than shop drawings and records, standard practice sheets, apprentice instruction, and time or production studies have in the duties of the foreman. He is not required today to be a traveling encyclopedia of shop information or a demonstrator; his time is too valuable for that. He is to lead, to know what is being done, to know how work should be done, and to get work done. He will correct wrong practices. He is usually the first man to discover frequent failures of parts and should be the first to seek the cause and suggest the remedy. In these matters he will use the same diligence that he would if he were manager of his own business. If the foreman does not display interest in such affairs they usually are not corrected as they escape the notice of his superiors because of lack of intimate knowledge of details and are accepted as being a permanent condition by the workmen having knowledge of their existence—the workman assuming that what is satisfactory to the foreman need not concern them.

The foreman must work in harmony with the heads of other departments, endeavoring to promote the interests of the entire organization, rather than to attempt to handicap other departments in order to reflect credit upon his own. He will listen carefully to suggestions for betterment from the men, showing his appreciation of their interest in their duties, and will apply their suggestions when consistent, not suppressing the identity of the proposer. When suggestions offered are not practicable good judgment must be used in rejecting them; otherwise, the impression may be given that they are not wanted. This tends to discourage future suggestions. Experience has shown that when a mechanic originates a certain tool or change and the improvement is carried out in accordance with his idea, two results are obtained. First, if the me-

* From a contribution entered in the *Railway Mechanical Engineer* competition on the foreman and his responsibilities.

Elevation drawing of the boiler of the New York Central 4-8-2 type locomotive

chanic is given the tool to use he will make more of an effort toward its successful operation than if it is the idea of the foreman or another workman. Second, he is encouraged to think of other improvements and naturally takes a greater interest in his work and in the affairs of his employer.

"Least law is the best law"

As the foreman's position is in the nature of a clearing house for the business transactions between the employer and the employee, it must be a well kept and orderly house. His is a constructive and responsible position. His attitude may bring benefit or the opposite to one or both of the parties. His qualifications must be above those required to hire, drive, and fire. No great degree of intelligence is required to dismiss a man from service by one having the authority to do so, but to stimulate interest and make a better workman of an indifferent employee is a work calling for the best that the foreman can bring forth. It is not implied that men should be coaxed to do their work, or that disregard of rules should be tolerated. On the other hand, the old adage, "The least law is the best law," deserves consideration in formulating shop rules.

The value of the product of the hand may be measured by the hourly rate and paid for on that basis, but the interest and loyalty of a body of men may be had at no monetary cost whatever. Tendered in return for what in their estimation is right in the attitude of the management toward them, loyalty and interest among the men are not beyond the reach of any foreman's ambition.

One example of loyalty is shown by the following incident: During the railway shop strike a few years ago, approximately 50 per cent of the men in a certain shop left their work. During the previous winter a group of 30 men had organized a night school class connected with the state vocational educational work and taught by a shop employee. The subject of the course was shop practice. In re-organizing the class the following term it was found in checking names that one single member of the class had left the service, although the members were scattered over several different departments. The fact that these men were sufficiently interested in their work to attend school on their own time showed them to be ambitious men. Their attitude in wishing to render better service by broadening their knowledge of their respective trades showed their loyalty and fair mindedness, afterward proven by their action during the strike. It is significant also that almost without exception each one bought and read the best mechanical magazines obtainable. A foreman may develop or eliminate a spirit of this sort by his attitude or comments. He is looked to by his men as being in a position to judge. Capable and efficient men lighten the labors of the foreman, give a greater return to the employer for the wages paid them, and, most important of all, give themselves a sense of self-reliance, self-respect, and permanency that is reflected in their home lives and families, making better citizens of all.

Suggestions for study

Volumes could be written covering the opportunities of the foreman. This brings to mind "Foremen—Spark Plugs or Grounded Wires," by Sherman Rogers, a work sufficiently appreciated by President Howard of the Commonwealth Steel Company to cause him to present copies to the delegates of Rotary International Convention in St. Louis in 1923.

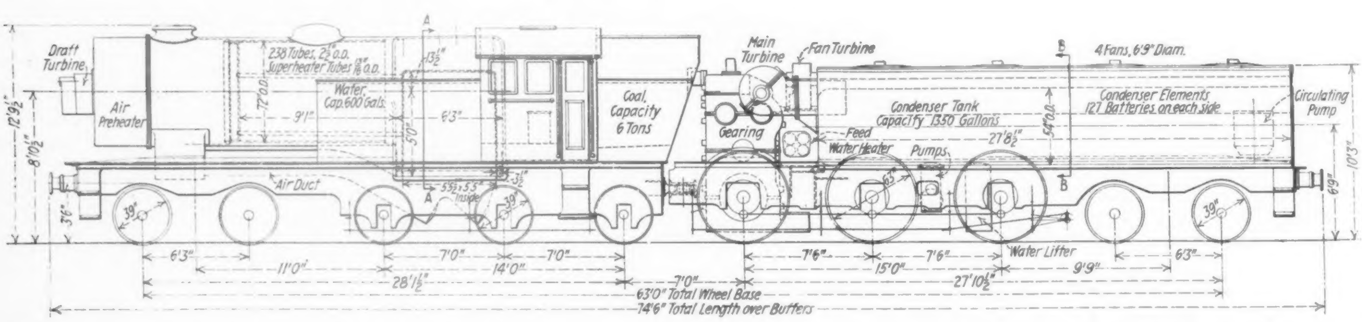
"What's on the Workers' Mind," by Whiting Williams, gives the author's experience covering a period of several months going from job to job as an untrained worker. Other practical books on the subject of management may be had by the foreman having the interest and energy to secure them. He will profit by study of his work.

Whether the foreman of today has been especially trained for his work or whether the foreman of the future is to be trained are matters decided by those above the foreman. The foreman has many opportunities within his reach should he care to grasp them:

First—In the interest of the employer—He can study his work in order to make the best use of the means at his disposal to secure an adequate return for the money expended for labor and material. At the same time he can prevent many unnecessary expenditures for labor and material—in this respect he can save a large amount.

Second—In the interest of the employee—He can make better workmen and better citizens of the men trusted to his guidance. He can train men to fill his place or the places of others when he or they pass onward. He can promote good will—a sympathetic word or a small kindness has a value not measured in dollars and cents.

Third—In his own interest—A man who schools himself to be competent in managing the affairs of others is training himself to manage his own affairs more successfully. His position as a foreman or chief man is an honorable and dignified occupation calling for intelligence and ability of a high order. President Vauclain of Baldwin Locomotive Works and President Chrysler of the Maxwell Motor Company are former railway shop mechanics. The transportation industry of today is a vast and growing business. Its shop management requires men of broader judgment and more general knowledge than is required in the highly specialized manufacturing industries. What better contribution can the railway shop foreman offer in his duty as a citizen than to labor to improve the quality of the commodity we offer the public—transportation.



Elevation drawing of Ljungström turbine condensing locomotive built for experimental purposes on the British railways by Beyer, Peacock & Co., Ltd., Manchester, England

Horsepower, main turbine, 2,000 hp.; boiler pressure, 285 lb. per sq. in.; heating surface of air preheater, 13,500 sq. ft.; cooling surface of condenser, 13,500 sq. ft.; maximum tractive force, 38,000 lb.

Some suggestions for future locomotive development

Details of boiler construction and its advantages—Side water legs stayed with cable wire

By *William A. Newman*

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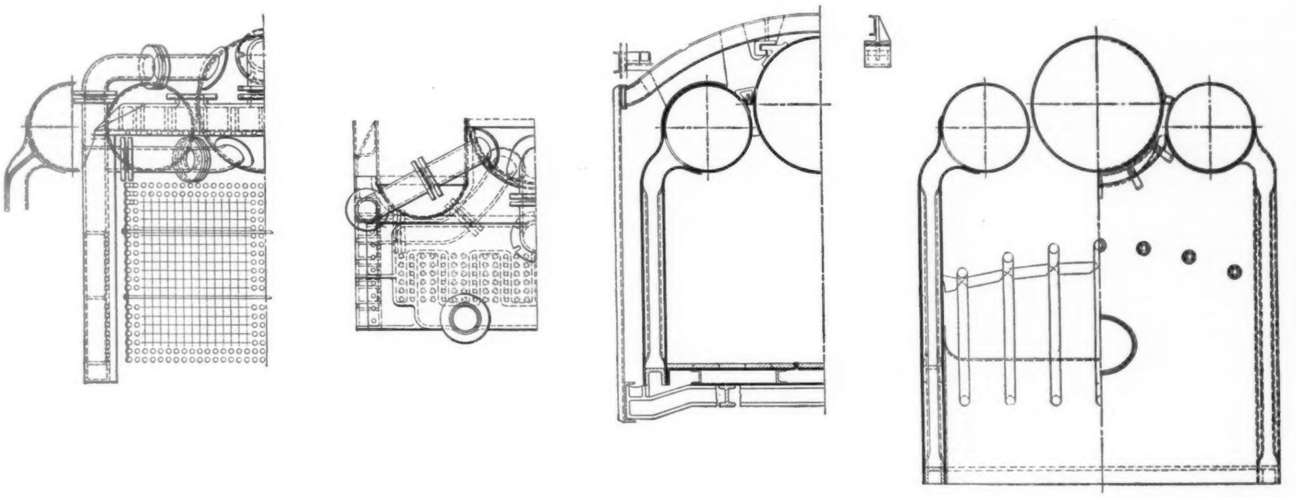
Part II

THE boiler itself forms the forward portion of the main locomotive frame; that is, the strength of the boiler structure is made use of partially to support its own weight. A channel side sill will run throughout the length of the locomotive which would be attached at intervals to the body bolsters, serving as ties across the bottom of the boiler, and also serving as center plate supports at the pivoting centers of the forward and rear trucks. The side walls of the water storage space at the rear of the main portion of the locomotive would also be constructed so as to be self supporting, and would be carried forward by structural members and attached to the side sill and top of the boiler construction in order to give the requisite strength through the operating cab.

Boiler construction and advantages claimed for it

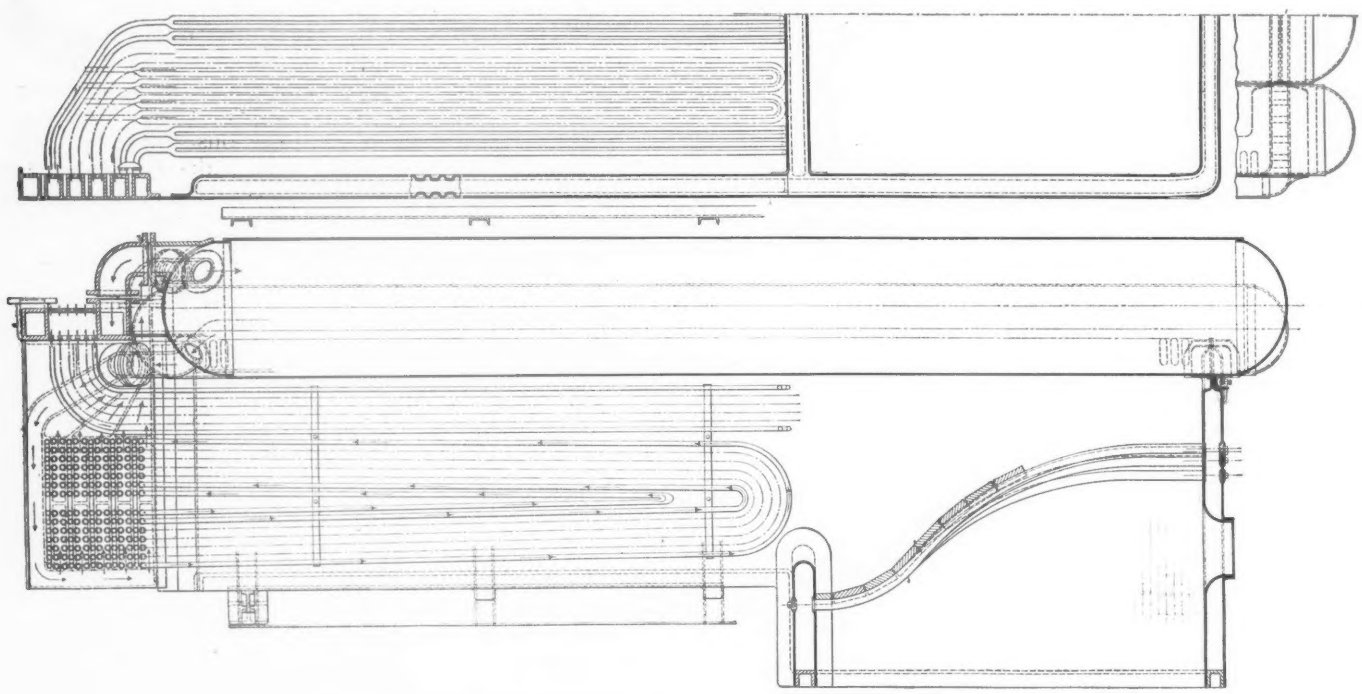
The general arrangement of the form of boiler suggested is shown herewith. While some details have been indicated on this drawing, they are entirely optional as there are a multitude of forms of construction that can be adopted to give the required results. However, it will be seen that the boiler, as shown, consists of two longitudinal drums running for the length of the boiler at the top, which are riveted to a water leg on each side of the boiler which extend down to form the firebox at the rear, and to give a rectangular space in front of the firebox which is carried through to the front end of the boiler. A larger central drum is carried between the two smaller drums, the three drums being fastened rigidly together at the front of the boiler and the central drum slung or suspended towards the rear so as to be free to expand and contract due to differences in temperature. This central drum is connected with nests of evaporating and superheating tubes, which really constitutes the steam generating side of the boiler. The underlying principle in the proposed design, aims at the elimination of all scale forming solids before the water is introduced into the small diameter high pressure evaporating tubes. Practically all scale forming solids are in solution in water at a temperature up to 360 deg. F. Beyond this temperature the solids go out of solution and become mechanically suspended in the water, at which stage they are in such a form that they would be readily deposited or baked into scale through adherence to hot surfaces. It is proposed to retain all solids in the first stage, the feedwater being fed directly into the upper small diameter drums from where it is circulated down into the water legs. This first stage, while carrying 170 lb. pressure, is not intended as an evaporator, but simply as a water heater, the water being carried at a high level in the drums and only sufficient space allowed to take care of the necessary expansion. The water level would be automatically regulated so as to be kept constant, and if a rise in pressure occurred, the water would be automatically passed into the second stage and make up water supplied from the water storage



Sections of boiler showing details of construction

tank, all the automatic regulation being worked out electrically by means of making and breaking of electric contacts. To transfer water from the low pressure stage into the higher pressure stage, two pumps are proposed mounted directly on the rear heads of the two small diameter outer drums. These pumps would consist of rotors submerged under the constant water level at all times, the rotor shaft having one bearing in the boiler and extending out through a packing gland to the outside of the boiler head where the rotor shaft would be driven by an electric motor. The rotor construction proposed, which would be mounted in a cast housing, also submerged in the interior of the boiler, would first impart a radially outward motion to the water which would tend to create a movement of the water in the casing in which the heavier solids in suspension would be thrown radially outwards, and a small core of water at the center of the moving mass would then be picked up and pressure imparted to it by the pump rotor proper and forced out central high pressure drum. All of this construction can be followed by reference to the illustrations and it will be noticed that in order to reduce the number of header connections that the evaporating pipes are made in multiples, two pipes being merged into one before the bend is made to establish the connection to the header, which will be carried out with a ball ring similar to what is now followed in superheater practice.

The evaporating unit clamps are secured to either header by through bolts, the nuts being applied on the outside of the header where they are exposed and readily removed and applied. In order to make the headers gas tight through the bolt holes, the nuts seat on ball washers. The upper or superheater header is connected directly into the steam space of the central drum, the course of the steam and the unit arrangement being exactly similar to the standard Type A superheater construction. In order to reduce connections, the unit pipes are merged together before the bend to the header connection occurs.



General arrangement of the boiler of the proposed steam locomotive

through a delivery passage and into the central high pressure drum carrying 300 lb. pressure. At the smokebox end of the boiler a combined smokebox and header chamber would be built up by two vertical side headers and one horizontal top header which would be bolted rigidly together and to the side water legs of the first stage, a plate connection also being made between the back wall of the horizontal header and the drum ends. The top horizontal header is the superheater header. The two side vertical headers provide connections for evaporating tubes. The water in the high pressure central drum is led through two delivery pipes to the side headers where it is carried through downward slanting diagonal passages to the front of the headers, and then passed down to horizontal passages at the bottom of the header, from which comb passages rise vertically, exactly as is customary on the standard Type A superheater headers. Nests of evaporating tubes are then connected with ball joints to these lower comb passages, so that the water circulates through the tubes, which have a constant vertical rise and then is carried to comb passages at the top of the vertical side headers which feed into a common top passage, which in turn has a connecting pipe back into the All superheating and evaporating pipes are 1½ in. in diameter. In order to give a definite circulation of water and steam, the feedwater is discharged into the center drum at the rear, is led into the evaporating headers from the front, and is then discharged from the latter in the form of steam towards the rear. The superheater always contains steam, and in the superheated steam passage of the header there are two outlets at which throttle valves are located, which are controlled separately and operated electrically. One throttle governs the supply of steam to the forward driving truck and the other to the rear driving truck.

Construction and method of staying side water legs

Some details of boiler construction have been indicated in the larger drawing among which is the side water leg construction which is shown in the form of vertical corrugations. These are introduced for the purpose of taking up the expansion which would be considerable in water legs of such length. They also serve to stiffen up the construction considerable, which is desirable on account of the boiler partially carrying its own weight. The use of staybolts is necessary in the water legs and

back head, and in this connection, while no definite details are submitted, it is suggested that some new type of flexible staybolt is necessary as none of the bolts heretofore in use is theoretically correct, as the relative movement of the sheets sets up severe strains at the junction of the threaded portion of the bolt and sheet. It is possible that flexible bolts could be made of flexible multi-strand cable which can be developed from very strong wire so that the diameter of the stay will be very much reduced. The flexible cable could be made up with one end permanently secured in a sleeve approximately 1¼ in. long, which would be in the form of a truncated cone with the entrance belled where the cable enters. This cone would rest against a bevelled reamed hole in the sheet, and the head project about 1/16 in. above the sheet to permit a beading being applied by electric welding. After this fixed end is inserted in one side sheet, a similar cone would be slipped over the end of the cable, at the outer side sheet, the cable drawn tight and bonded electrically to the sleeve by passing a current between contacts gripping the sleeve between them. The circumference of the outer sleeve would also be welded to the sheet as was done for the opposite end. Considerable development would be necessary to bring this arrangement to the practical stage, but the use of such stays should materially improve conditions in side sheets. An alternative construction could be used whereby the water legs could be divided into sections and expansion joints provided to take up the forward and rear sheet movement. It will be noted that considerable care has been taken in the proposed construction to allow the location of washout plug directly above the side passages so that free access to the sides for washing out is readily obtained. Manholes would also be located in the three upper drums to permit easy access for cleaning.

The tender

The fuel and water storage space is located at the rear of the operating cab. The fuel storage space consists of a wedge-shape hopper of uniform width, the rear wall of which is sloped at such an angle that the coal is fed forward of its own weight. At the point of the wedge shape hopper, which is at the bottom, the coal is delivered to the stoker conveyor. The fuel space would be shut off entirely from the operating cab, although a door would be provided opening into it for emergency use. The framing construction permits the use of practically any type of stoker desired, and in a simplified form as no universal joints are required as there is no relative movement between the boiler and the fuel storage space, as is the case with the standard type of locomotive and tender. While practically any standard type of stoker can be used, it is suggested that an underfeed stoker of practically identical design as is used in stationary practice would give an efficient arrangement, and possess some advantages over current designs of locomotive stokers. The stoker mechanism would be driven electrically.

Stack draft supplemented by forced draft

As previously mentioned, the exhaust steam from the forward driving unit is ejected directly into the stack in practically the same way as is done at the present time. It is felt that this draft should be sufficient to provide the necessary air for combustion during a considerable portion of the time that a locomotive is in operation. To take care of higher evaporative rates, it is proposed to supplement the stack draft by forced draft to be provided by a compact centrifugal fan located in the operating cab, driven either by a steam turbine or electric motor, depending upon the amount of power required. This fan would feed the air under pressure to hollow grate bars. Most of the air supply would also be heated, the base of the boiler proper being constructed in the form of ducts on the top of which thin fire bricks are cemented in place. The front of these ducts end in a funnel-shape opening at the front of the locomotive which is screened, and, due to the motion of the locomotive, air will be forced through the duct, heated and injected under the grates. The locomotive velocity will, therefore, assist the stack exhaust in injecting the necessary air supply under the grates. The suction for the centrifugal fan would also be connected to these heating ducts to provide as far as possible for the heating of all air used for combustion. It is expected that with such a draft arrangement, a degree of flexibility in boiler operation can be realized that will permit of maximum economy of operation, both as to low and high steam demands. It should also permit of a relatively smaller boiler as forcing should provide for maximum steam requirements.

Combined condenser and feedwater heater in conjunction with the water reservoir

The water storage space at the rear of the locomotive consists of a solid rectangular storage tank, with the exception of a wedge-shape space, through the center, which serves as a fuel storage well, the whole structure being rigidly braced after the manner of standard tender practice. The side walls of the tank will be riveted directly to the structural steel members to give strength to the locomotive body side framing. The side walls would then be panel insulated and covered on the exterior by a series of removable panels which form the exterior of the locomotive. The exhaust from the rear power truck would be used for preheating the feedwater. The heater may be of either the closed or open type, but the closed type is suggested to consist of a horizontal steam cylinder, enclosing water circulating coils after the manner of existing heater construction. The heater would be located in the water tank space at the top, so as to drain the condensate by gravity into the water storage space. The exhaust from the main auxiliary turbo-generator would also discharge into the feedwater heater. The feedwater would be fed direct to the first pressure stage by a compact triplex pump, located below the lowest level so that a gravity feed is obtained. The triplex pump would be gear-driven by an electric motor, so that it can operate at low speed to give a constant low velocity discharge and permit maximum flexibility of regulation.

Auxiliary equipment

In general, it is proposed to operate all auxiliaries by electrical energy developed by a compact direct current generator, direct connected to a steam turbine.

Most of the auxiliary equipment has been already referred to, the boiler feed pumps being electrically driven and the draft pressure fan, either steam or electric driven. It is also proposed to drive the air compressor electrically. The lubrication will be attended to by individual electric motor-driven oil pumps located on the frame of each driving unit. The throttle regulation will also be carried out by electrical control. It will be possible to operate the throttles either separately or in parallel. The cut-off regulation requires only the manual manipulation of a comparatively small lever, as all that is necessary to do is to establish electric connections with proper segments on the commutators surrounding the main axles.

It is proposed that all water levels be automatically regulated by electrical means, so that pumps are automatically cut in as the water levels fall and cut out as they rise to a predetermined level, provisions being made for the engineman manually to control the level if desired. It is further proposed that all water levels be registered

electrically on a central instrument board. To allow the operation of two locomotives together, it is proposed to arrange the controls so that the throttle and valve motion can be entirely regulated from the leading locomotive by cutting in electrical connections between the two locomotives. The water levels and pressures can be also electrically registered on duplicate registering devices on the first locomotive so that one engineman and two firemen may readily operate two locomotives operating in service together.

General comments on electrical control, general construction and possibilities for development

The use of electrical energy for the operation of auxiliaries and the control of the distribution of the steam should open an extensive field for improvement in operation and gains in economy. Automatic electrical control has been developed to a high state on a very wide-spread range of machinery and equipment, and it is felt that its introduction into locomotive engineering should introduce a very marked possibility for greater expansion. It is true that the entire scheme is somewhat visionary, and would require extensive development. On the other hand, the whole proposal would appear to be feasible and the advantages to be gained would merit investigation into its possibilities.

The total overall length of the locomotive between coupler knuckles is 71 ft., which is considerably less than that for modern locomotives of equal capacity. It is felt that the length of the present modern steel passenger cars may be taken as a possible limit of length, which is 85 ft. There is, therefore, 14 ft. expansion still possible for greater capacity locomotives. The locomotive shown can have its wheel arrangement modified to provide for two-wheel engine trucks, which would permit the use of three pairs of 58-in. diameter driving wheels in practically the same length of wheel base, so with very little increase in length it would be possible to develop a tractive force of 110,000 lb. without exceeding a 60,000-lb. axle load. With further increases in the weight on drivers within limits that are now being worked to, still further large increases in tractive force are possible, if necessary for special designs of heavy service locomotives. All tractive forces quoted have been for conservative factors of adhesion, and it is expected that with a practically constant torque, especially with the increase in number of drivers, that lower adhesion can be worked to, which again will permit further increases in tractive force. When it is considered that a tractive force of 180,000 lb. can be developed with eight 58-in. diameter drivers, 300-lb. steam pressure and cylinders 20-in. diameter, it will be seen that there are ample possibilities for development of the proposed type of locomotive without going to excessive weights or size of cylinders. It is, however, thought that further development can be made with higher pressures as this is one of the most fruitful sources for gains in economy of operation. Three hundred pounds pressure has been selected as a moderate advance which would permit appreciable superheat without exceeding a total steam temperature of 700 to 750 deg. F. With the construction proposed, however, there is no reason why higher pressures cannot be used as soon as sufficient experience has been gained, which will have the effect of holding down cylinder sizes with minimum effect on weights of reciprocating parts. The cost of a locomotive, as herein described, would be greater on a weight basis than the standard type steam locomotive. The cost should, however, be very much less than equal capacity electric locomotives and the gain in economy and increased flexibility of operation should warrant any increase in cost which, viewed from any angle, should be very much less than any type of Diesel or turbine locomotive yet proposed.

One feature that may be criticized in the proposed assembly is poor vision for the engineman on account of the location of the operating cab. It is possible that a rearrangement of the boiler, fuel and water spaces might better this, but it is felt that the vision provided is equal to what exists on the largest locomotives now in service, on which feedwater heaters and other appliances restrict the view fully as much as in the proposed form. In order to give the engineman some protection in severe weather, a permanent lookout can be built on the side of the cab, projecting out approximately 6 in., similar to what is done on some classes of cars at the present time, which used in conjunction with some form of clear vision window, should give equal or better vision than what is obtained on large locomotives now in service.

In conclusion, it should be stated that although there is very little new in what has been suggested, yet the proposed regrouping of old ideas constitutes some novel and radical combinations. All these require very thorough investigation before adoption is possible, which, on account of the magnitude of the task, it is almost impossible to make without the undivided efforts of a considerable and experienced engineering staff. For this reason it is thought more desirable to submit the above grouping of ideas for discussion and comment in the hope that locomotive engineering as a whole will benefit, rather than to attempt to prove or disprove the proposals by private development.

Table of dimensions, weights and proportions

Type of locomotive, Thermo-electric	4-4-0+4-4-4
Service	Freight
Cylinders, diameter and stroke	8—13 in. by 26 in
Valve gear, type	Any
Valves	Piston or poppet
Cut-off in full gear, per cent	Zero to 100
Weights in working order:	
On drivers	240,000 lb.
On each of 3 trucks	100,000 lb.
Total engine and tender	540,000 lb.
Wheel bases:	
Rigid	5 ft. 6 in.
Total engine	62 ft. 9 in.
Total engine and tender	62 ft. 9 in.
Wheels, diameter outside tires:	
Driving	63 in.
All trucks	36 in.
Journals, diameter and length:	
Standard	A. R. A.
Boiler:	
Steam pressure	300 lb.
Fuel, kind	Bituminous
Arch tubes, number	7
Heating surfaces.	
Firebox and shell	612 sq. ft.
Water tubes	2,870 sq. ft.
Total evaporative	3,482 sq. ft.
Superheating	1,328 sq. ft.
Comb. evaporative and superheating	4,810 sq. ft.
Special equipment:	
Brick arch	Yes
Superheater	Type A
Feedwater heater	Built in
Stoker	Underfeed
Tender:	
Water capacity	9,000 imp. gal., 10,800 U.S. gal.
Fuel capacity	12 ton
General data estimated:	
Rated tractive force	71,400 lb.
Weight proportions:	
Weight on drivers ÷ total weight engine, per cent	44.5
Weight on drivers ÷ tractive force	3.36
Total weight engine ÷ comb. seat. surface	112.2
Boiler proportions:	
Tractive force ÷ comb. heat. surface	14.8
Tractive force × dia. drivers ÷ comb. heat. surface	935.6
Firebox heat. surface, per cent of evap. heat. surface	17.6
Superheat. surface, per cent of evap. heat. surface	38.1

The Wisconsin law requiring curtains on locomotive cabs has been sustained by the Supreme Court of that state. This ends litigation in the state courts which was begun in 1923, when the law was passed. The court held that the law was passed in the interest of the public health and therefore does not violate the principle of federal regulation of interstate commerce. The railways are expected to appeal the case to the United States Supreme Court.

Locomotive and motor car orders in 1925

Three new locomotive types developed during the past year —Increasing interest in the Diesel engine

THE number of locomotives ordered for domestic service in the United States during 1925 totaled only 1,055. This figure compared with 1,413 in 1924; with 1,944 in 1923 and with 2,600 in 1922, shows that last year was the third successive year in which there has been a substantial decrease in locomotive orders from the year preceding. The 1925 total was, furthermore, the smallest for any year since 1900, with the exception of the subnormal years of 1919 and 1921. Of the 1,055 locomotives ordered last year, 14 were oil or Diesel-electric and 28 were electric locomotives. Orders placed by the railroads in Canada with the locomotive builders only amount to 10, as compared with 71 ordered in 1924 and 82 ordered in 1923, as shown in Table 1.

An interesting feature in the locomotive orders for 1925 is the number ordered for export to Central and South America. Of the 209 locomotives exported, 46 went to Brazil and 62 went to other countries in South and Central America. This is due principally to the fact that many of the railroads of South and Central America have been required to borrow money for new equipment and improvements in the United States. In 1924, the National Railways of Mexico ordered 50 locomotives as well as a large number of cars. There were, however, no locomotives sold to Mexico in 1925. Other export business, aside from the countries mentioned, totaled 101 locomotives. The number of locomotives built for domestic service—in contradistinction to new business taken as shown in the total number of orders—was 994. This figure was inclusive of Canadian production. It compared with 1,810 in 1924, and with 3,505 in 1923, and was the smallest total reported since 1897.

Table I—Orders for locomotives since 1918

Year	Domestic	Canadian	Export	Total
1918	2,593	209	2,086	4,888
1919	214	58	989	1,170
1920	1,998	189	718	2,905
1921	239	35	546	820
1922	2,600	68	131	2,799
1923	1,944	82	116	2,142
1924	1,413	71	142	1,626
1925	1,055	10	209	1,274

The Car Service Division of the American Railway Association reports monthly totals of locomotive installations and retirements. For the year 1924 these reports showed that there were installed 2,246 locomotives and that there were retired 2,148. The last report available for 1925 to date is that for November. In the first 11 months of 1925, installations totaled 1,604—indicating a figure for the year approximating the total for 1924—while retirements for the 11 months totaled 2,626.

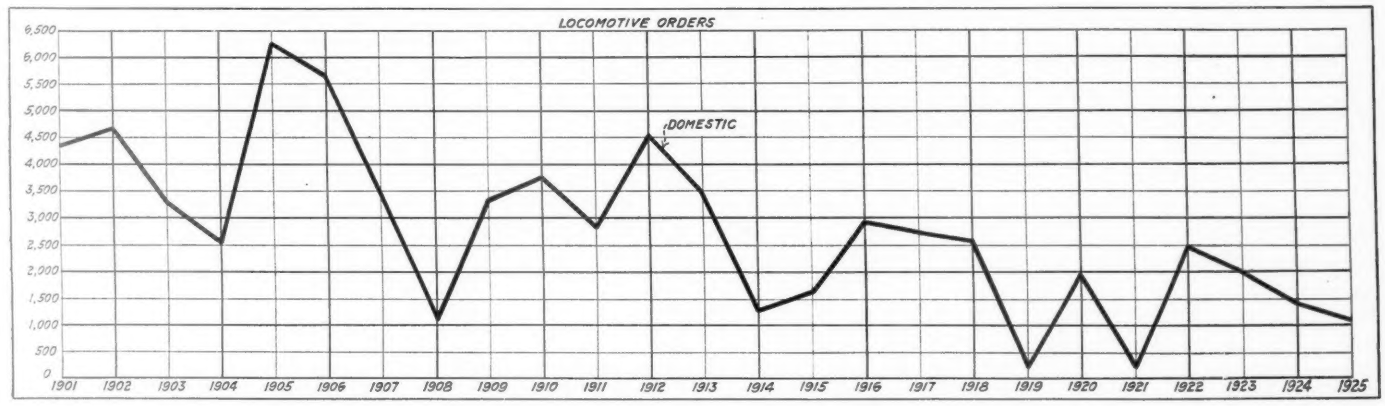


Chart showing the locomotive orders, 1901 to 1925

Types of locomotives ordered

Table II gives a summary of the more important orders placed in 1925 grouped according to roads and types.

Table II—Important locomotive orders in 1925

	0-6-0	0-8-0	2-8-2	2-8-4	2-10-0	2-10-2	2-10-4	Mallet	4-6-2	4-8-2
A. T. & S. F.	..	..	..	..	..	15	..	..	..	..
A. C. L.	8	10	..	..	..	20	..	..	75	..
B. & O.	..	..	..	..	..	50	..	..	..	..
Belt Ry. of Chicago	..	5	..	..	..	..	..	..	..	..
B. & A.	..	..	..	25	..	..	..	..	..	..
Can. Nat.	..	..	..	..	..	..	..	..	..	5
C. of Ga.	..	..	..	..	..	10	..	..	..	10
C. & O.	..	..	50	..	..	..	..	20	5	..
C. B. & Q.	..	..	..	..	..	..	..	..	..	13
C. R. I. & P.	..	10	..	..	..	10	..	..	..	..
D. & R. G. W.	..	..	10	..	..	..	..	..	..	10
Detroit Terminal	..	7	..	..	..	..	..	..	..	..
Fla. E. C.	..	6	15	..	..	..	..	..	..	12
Great Northern	..	..	16	..	..	..	..	..	..	..
Gulf C. L.	..	..	10	..	..	..	..	..	..	..
G. M. & N.	..	..	..	..	5	..	..	..	..	..
Hocking Valley	..	10	..	..	..	..	..	..	..	..
I. G. N.	..	..	..	..	..	..	..	..	5	..
K. C., M. & O.	..	..	..	..	5	..	..	..	..	..
L. & N.	..	..	24	..	..	..	..	..	..	8
M. P.	..	15	..	..	..	10	..	..	..	..
N. C. & St. L.	..	..	..	..	..	..	..	..	..	5
N. Y. C.	..	5	..	..	..	..	..	..	..	100
N. Y., C. & St. L.	..	20	..	..	..	..	..	..	..	..
N. Y., N. H. & H.	..	..	..	..	..	..	..	..	..	10
N. & W.	..	..	..	..	..	..	..	..	..	10
Reading	..	5	..	..	..	..	..	..	..	..
St. L.-San Fran.	..	..	30	..	..	..	..	..	..	15
S. A. L.	..	..	74	..	..	..	..	..	..	21
T. & P.	..	10	..	..	..	..	10	..	..	5
Wabash	..	25	..	..	..	..	..	..	..	..

This list includes 854 locomotives for 31 railroads, or 80.2 of the locomotives ordered by the American and

Canadian roads. The balance was in small orders from a number of railroads.

A list of the types of locomotives which were ordered for the railroads, industrial concerns and for export is shown in Table III. Similar information for the preceding year is given on page 91 of the February, 1925, issue of the *Railway Mechanical Engineer*. For the railroads alone, a total of 993 locomotives were ordered in 1925. Of this total, 453 or 25.5 per cent were for freight service and 338 or 34 per cent were ordered for passenger service.

Table III—Types of locomotives ordered in 1925

Type	Railroad	Industrial	Export	Total
0-4-0	0	13	0	13
0-6-0	22	14	0	36
0-8-0	132	0	0	132
0-10-0	1	0	0	1
2-6-0	1	2	3	6
2-6-2	4	7	2	13
2-6-4	0	1	0	1
2-8-0	17	3	37	57
2-8-2	247	15	84	346
2-8-4	25	0	0	25
2-10-0	11	0	0	11
2-10-2	115	0	0	115
2-10-4	10	0	0	10
Mallet	22	3	0	25
4-4-0	0	1	6	7
4-4-2	5	0	0	5
4-6-0	1	0	4	5
4-6-2	93	0	41	134
4-8-0	4	0	0	4
4-8-2	235	0	16	251
4-12-2	1	0	0	1
Geared	0	11	0	11
Miscellaneous	47	2	16	65
	993	72	209	1,274

For switching service 155 locomotives were ordered. The preponderance of the orders were for the 0-8-0 type, which was the same as for 1924, 295 being ordered in that year and 132 in 1925. The largest orders for switch engines were those placed by the Missouri Pacific and the New York, Chicago & St. Louis, for which there were 15 and 20 of the 0-8-0 type, respectively. There were only eight of the 0-6-0 type ordered in 1925, as compared to 13 ordered in 1924. All of the 0-6-0 type ordered last year were for the Atlantic Coast Line.

Of the locomotives with two-wheel leading trucks and three, four or five pairs of drivers, locomotives of the 2-8-2 type were the largest number ordered last year. In this group are 247 or 25 per cent of the total. The next largest number ordered is the 2-10-2 type of which there is a total of 115, or 11.6 per cent of the total. Roads which placed orders for at least 25 locomotives of the 2-8-2 type were the Chesapeake & Ohio, the St. Louis-San Francisco and the Seaboard Air Line. The Baltimore & Ohio ordered 50 of the 2-10-2 type which was the largest order for that type placed during the year.

Table IV—Principal orders for 4-8-2 locomotives in 1925

Road	No.	Weight, lb.	Tractive force, lb.
New York, New Haven & Hartford	3	376,000	67,300
New York Central	100	368,700	72,700
Chicago, Burlington & Quincy	13	367,700	52,750
New York, New Haven & aHrtford	7	360,000	67,300
St. Louis-San Francisco	10	346,000	54,100
Louisville & Nashville	8	327,000	53,900
Seaboard Air Line	10	320,900	48,200
	11	320,500	48,200
Florida East Coast	12	318,000	44,000
Central of Georgia	10	316,500	47,800

There were 22 Mallet locomotives ordered in 1925, or 12 less than the number ordered in 1924. The largest order for this type was 20 for the Chesapeake & Ohio. Of the total of 338 locomotives ordered last year of the type usually employed in passenger service, 235 were of the 4-8-2 type or 23.7 per cent of the total. The second largest group is 93 of the 4-6-2 type, of which 75 were ordered by the Atlantic Coast Line.

During the past year, three new types of steam locomotives appeared on the railroads of the United States. These are the 2-8-4 type, built by the Lima Locomotive Works, Inc., the 4-10-2, three-cylinder locomotives, built for the Southern Pacific and Union Pacific by the American Locomotive Company, and the 2-10-4 type recently received by the Texas & Pacific from the Lima Locomotive Works, Inc. The Southern Pacific 4-10-2 type locomotives, of which 16 were ordered in 1924, have a tractive force of 76,900 lb. without the booster, 83,500 lb. with the booster, and a weight of 306,000 lb. on the drivers. The 2-8-4 type which was described in the May issue of the *Railway Mechanical Engineer*, has a tractive force of 69,400 lb. without the booster and 82,600 lb. with the booster. The total weight on the drivers is 248,200 lb. The 2-10-4 type built for the Texas & Pacific, was described in the January issue of the *Railway Mechanical Engineer*, page 5. It has a rated tractive force of 83,000 lb. with the engine and 96,000 lb., including the booster. The weight on the drivers is 300,000 lb.

Table V—Principal orders for 2-8-2 locomotives in 1925

Road	No.	Weight, lb.	Tractive force, lb.
Chesapeake & Ohio	50	357,500	67,700
St. Louis-San Francisco	15	344,600	59,800
	15	328,800	59,800
Gulf Coast Lines	10	333,000	59,800
Great Northern	7	320,100	56,600
	9	283,420	50,600
Louisville & Nashville	24	320,000	60,000
Seabcard Air Line	54	302,000	66,200
Florida East Coast	15	297,000	54,700
Denver & Rio Grande Western	10	171,420	36,200

New locomotive types are the result of efforts to meet demands for increased capacities

The new locomotive types exemplify the continuous effort for an increase of locomotive capacity which has been characteristic of steam locomotive development throughout its history. The Lima 2-8-4 type locomotive represents an effort to meet the demand for increased train load and the reduction of time on the road. The purpose of an additional pair of truck wheels incorporated in the 4-10-2 design of the ten-coupled 3-cylinder locomotives is to meet the demand for the utmost in horsepower capacity which can be secured from a locomotive with a given number of driving wheels by providing the largest practicable boiler. The same may be said for the Texas & Pacific 2-10-4 type locomotives which are a development from the 2-8-4 type design.

Articulated type locomotives still retain their usefulness under special operating conditions. There is a marked tendency in recent locomotives of this type toward the use of simple cylinders. An outstanding locomotive of this type built during the past year is the Great Northern 2-8-8-2 type locomotive which has four 28-in. by 32-in. cylinders and has a starting tractive force at a maximum cut-off of 65 per cent of 127,500 lb.

Table VI—Principal orders for 0-8-0 locomotives in 1925

Road	No.	Weight, lb.	Tractive force, lb.
Reading	5	280,610	67,900
Terminal R. R. Assn. of St. Louis	2	252,500	60,300
Detroit Terminal	5	239,000	55,200
Chicago, Rock Island & Pacific	10	230,000	......
Missouri Pacific	15	224,490	53,958
New York, Chicago & St. Louis	20	221,000	51,000
Texas & Pacific	10	220,000	54,500
Hocking Valley	10	221,000	51,200
Wabash	25	217,500	52,921
Florida East Coast	6	216,000	51,000
Atlantic Coast Line	10	215,300	51,041

Tendencies as to size

The idea of the size of locomotives required to meet present day operating conditions may be obtained by

referring to Tables IV to VI, inclusive, in which important orders for the leading types placed last year are grouped according to weight. Similar information for the 0-8-0, 2-8-2, 4-6-2 and 4-8-2 types of locomotives ordered in 1924 will be found on pages 91 and 92 of the February, 1925, issue of the *Railway Mechanical Engineer*.

The majority of the locomotives of the three-cylinder design ordered in 1925 were of the 4-8-2 type. The Louisville & Nashville placed the largest order for locomotives of this design included in Table IV. The weight of these locomotives does not differ materially from the average weight of those of two-cylinder design.

As shown in Table V, the heaviest locomotives of the 2-8-2 type were ordered by the Chesapeake & Ohio. These locomotives have a weight of 357,500 lb., which is 12,900 lb. heavier than those of the St. Louis-San Francisco, listed in the same table. The five 0-8-0 type locomotives ordered by the Reading, weigh 280,610 lb., which is approximately 34,000 lb. heavier than the three-cylinder 0-8-0 locomotives ordered by the New York, New Haven & Hartford in 1924. The largest order for locomotives of the 0-8-0 type, shown in Table VI, is for 25 ordered by the Wabash.

Comments on design

Three developments of outstanding interest in design which have appeared during the past year were all incorporated in the two new locomotive types built by the Lima Locomotive Works, Inc. These are the articulated four-wheel trailing truck, the added capacity of which has been utilized to increase the size of the firebox and boiler; the cast steel cylinder with its saving in weight, which again permits more weight in the boiler, and the articulated main rod which, by delivering the driving force to two, instead of to one main crank pin, has materially increased the limit of cylinder load which can be taken up by a single coupled driving wheel base from a single pair of cylinders without excessive crank pin and driving box loads.

A year ago in discussing the tendencies of equipment design of 1924, attention was called to the Delaware & Hudson consolidation type locomotive designed by John Muhlfeld, the most important factor of which was probably its boiler pressure of 350 lb. During the past year, no locomotives have been built in America to carry such high boiler pressures, but there has been some increase in the use of pressures considerably above 200 lb., which for many years has been quite general practice.

The outstanding development in the use of high pressures this year took place in Europe. A German locomotive has been been built with a boiler generating steam at two pressures. Superheated high pressure steam at 850 lb. per sq. in. is used in a single high pressure cylinder and the exhaust from this cylinder, at about 200 lb. per sq. in., is combined with superheated steam at the same pressure drawn from the low pressure section of the boiler, to supply the two low pressure cylinders. Little is known as to the performance of this locomotive, but a marked economy in steam consumption is reported.

The tendency towards large tender capacity is continued during 1925. Many of the locomotives built during the year have been equipped with tenders carrying from 12,000 to 15,000 gallons of water and as much as 20 tons of coal and 5,000 gallons of oil.

Table VII—Oil-electric or Diesel-electric locomotives ordered in 1925

Purchaser	No.	Wheel arrangement	Service	Weight, lb.	Tractive force, lb.	Cylinders, No., dia. and stroke	Builders
Baltimore & Ohio	1	0-4-4-0	Sw.	120,000	50,000	6—10x12	Ingersoll Rand-Amer.-Gen. Elec.
Central of New Jersey	1	0-4-4-0	Sw.	120,000	30,000	6—10x12	Ingersoll Rand-Amer.-Gen. Elec.
Chicago & North Western	1	......	Sw.	120,000	......	....	Ingersoll Rand-Amer.-Gen. Elec.
Delaware, Lackawanna & Western	2	......	Sw.	120,000	......	....	Ingersoll Rand-Amer.-Gen. Elec.
Erie	1	0-4-4-0	Sw.	120,000	300 hp.	6—10x12	Ingersoll Rand-Amer.-Gen. Elec.
Lehigh Valley	1	0-4-4-0	Sw.	120,000	36,000	6—10x12	Ingersoll Rand-Amer.-Gen. Elec.
Long Island	1	......	Frt. and sw.	200,000	600 hp.	6—10x12	Ingersoll Rand-Amer.-Gen. Elec.
	1	Gas-electric	....	120,000	500 hp.	....	Westinghouse-Brill.
New York Central	1	4-8-4	Pass.	296,000	......	....	McIntosh & Seymour-Amer.-Gen.-Elec.
	1	4-8-4	Frt.	257,000	......	....	Ingersoll Rand-Amer.-Gen. Elec.
Pennsylvania	3	0-4-0	Sw.	130,000	42,500	....	Bessemer-P. R. R. Shops.

Table VIII—Rail-motor car orders in 1925

	Gasoline	Gas-electric	Steam	Trailers	Total
United States	75	54	0	19	148*
Canada	7	0	0	0	7
Export	32	1	1	0	34
Total	114	55	1	19	190*

*Includes 19 trailer cars.

Table IX—Number, type and weight of rail motor cars ordered in 1925, for service in the United States and Canada

Builder	Type of power plant	No. motor cars	Horsepower	Nominal weight, lb.
J. G. Brill Co.	gasoline	1	250	55,000
	gasoline	1	50	21,000
	gasoline	2	65	50,000
	gasoline	5	70	30,000
	gasoline	1	125	30,000
	gasoline	7	150	53,000
	gasoline	2	175	53,000
	gasoline	9	190	53,000
	gasoline	6	190	54,000
	gasoline	2	190	56,000
	gasoline	6	190	57,000
	gasoline	1	190	58,000
	gasoline	1	190	59,960
	gasoline	1	190	65,200
	gasoline	1	...	70,000
	gas-electric	1	175	74,400
	gas-electric	2	250	76,000
	gas-electric	3	250	80,000
	gas-electric	6	250	90,000
	gas-electric	7	250	110,000
Westinghouse-Brill	M. U. gas-electric	1	250	88,000
Canadian Pacific*	gasoline	2	150	33,300
Edwards	gasoline	1	40	12,000
	gasoline	1	75	18,000
	gasoline	4	200	42,000
	gasoline	3	200	43,000
	gasoline	6	200	69,000
	gasoline	1	104	50,000
Electro-Motive Co.	gas-electric	6	175	70,000
	gas-electric	2	175	72,000
	gas-electric	6	175	78,600
	gas-electric	1	175	79,900
	gas-electric	3	185	72,000
	gas-electric	5	200	73,000
	gas-electric	2	400	......
	gas-electric	2	200	76,000
	gas-electric	4	210	83,000
	gas-electric	2	105	70,000
Liveoak, Perry & Gulf*	gasoline	1	70	17,000
Mack Motor Car Co.	gasoline	1	80	20,000
Meister Co.	gasoline	1	60	12,000
Pullman	gas-electric	2	300	......
Railway Motors Corp.	gasoline	2	208	79,300
	gasoline	2	208	70,000
	gasoline	3	208	75,000
H. J. Reith	gasoline	1	125	30,000
Sykes	gas-electric	2	175	62,000
	gasoline	5	225	59,180
		137		

*Built in company shops.

The Diesel locomotive

A total of 14 Diesel-electric locomotives were ordered for domestic service in 1925. A list of these locomotives is shown in Table VII. Nine of the units ordered last year have Ingersoll-Rand oil engines. One is a gas-

electric locomotive built jointly by the Westinghouse and J. G. Brill Companies; one built jointly by McIntosh & Seymour, American Locomotive Company, General Electric Company, and three by the Bessemer Gas Engine Company and the Pennsylvania Railroad. The heaviest locomotive of this class is the 600-hp. oil-electric locomotive for freight and switching service recently delivered to the Long Island Railroad, which weighs 200,000 lb.

Rail motor cars ordered in 1925

In 1923, the railways in the United States and Canada ordered 76 rail-motor cars; in 1924, the number increased to 120, and for 1925 the lists show a total of 137. Of this total, 82 are driven direct by gasoline engines of which seven were ordered by Canadian railways, 54 are gas-electric transmission and one has multiple-unit control. Table VIII shows the number of rail motor cars ordered for service in the United States and Canada and for export. Shown in Table IX is a list of the rail-motor cars ordered in 1925 for service in the United States and Canada, classified according to the builder, type of power plant, horsepower and nominal weight. Among the important orders for rail-motor equipment is that placed by the Boston & Maine, which includes a total of 12 rail-motor cars and five trailers. The Missouri Pacific also placed orders for seven motor cars and five trailers.

Undoubtedly the outstanding development in rail-motor cars built during the past year is the application of the Diesel engine to a number of cars on the Canadian National and the application in two of these of the articulated principle with a 350-hp. motor. These cars were described in the November, 1925, issue of the *Railway Mechanical Engineer*. The design of these motors in themselves is of more than ordinary interest because of the high crank shaft speed and the unusually light weight per horsepower which was attained in them.

Another development in design which has been embodied in many of the orders placed during 1925, is the double-end control, where electric transmission is used. This has been worked out to a point where multiple unit control is available should there be any demand for trains using more than one motor car. There has been a general tendency to increase the weight and horsepower capacity of this equipment.

100-ton oil-electric locomotive

Built for freight and switching service on the Long Island — Develops a tractive force of 60,000 lb. at one mile an hour

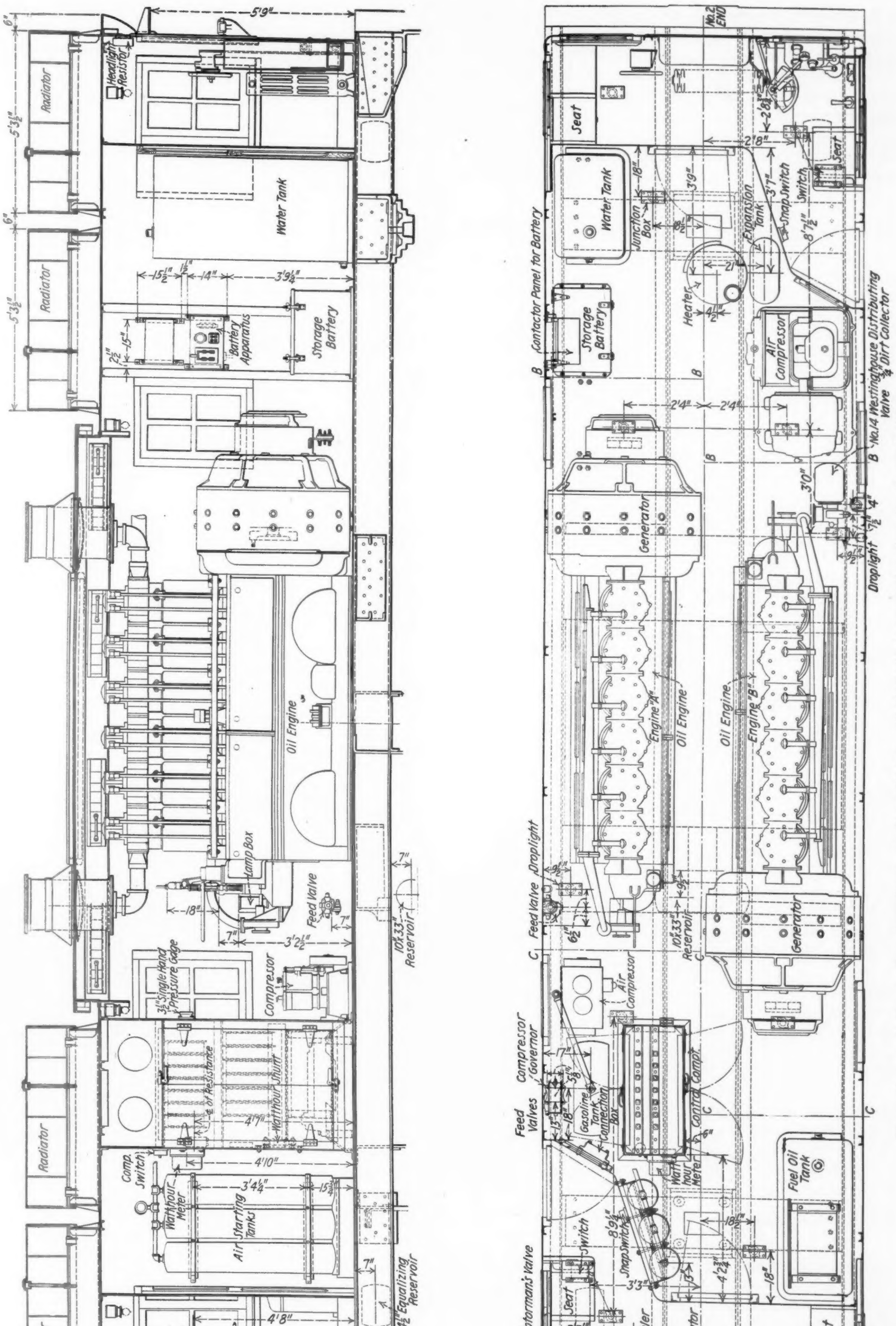
A 100-ton oil-electric locomotive built jointly by the Ingersoll-Rand Company, the General Electric Company, and the American Locomotive Company was delivered the latter part of December, 1925, to the Long Island for use in freight and switching service. This locomotive was run under its own power, hauling five loaded box cars, one passenger car and a caboose, from Erie, Pa., to Greenville, N. J. Records taken during this run show a consumption of 473 gal. of fuel oil for a total running time of 28 hr. 45 min.

The design and construction of the 100-ton locomotive is similar in many respects to the 60-ton oil-electric locomotive built by the same companies and described in the July, 1924, issue of the *Railway Mechanical Engineer*. One of these 60-ton locomotives has been in switching service for several weeks in the Bronx, N. Y., freight terminal yards of the Central Railroad of New Jersey.

The cab of the 100-ton oil-electric locomotive is of all-steel construction and extends the entire length of the locomotive. Its general appearance is similar in many respects to that of an electric locomotive. The width of the cab is 9 ft. 4 in. and the overall length is 40 ft. The overall height of the locomotive, measured from the top of the rail, is 13 ft. 9½ in. The cab is divided into three compartments. The central compartment contains the power plant, oil and water tanks, control equipment and heater. The two end compartments are reserved for the control and operating apparatus. Clear vision for the operator is provided by means of end and side windows. A hatch is provided in the roof of the central compartment directly above the oil engines to permit their removal. A smaller hatch is also provided in the main hatch to facilitate inspection.

The major equipment consists of two 300-hp., six-

100-ton oil-electric locomotive built jointly by the General Electric Company, Ingersoll-Rand Company and the American Locomotive Company



Elevation and floor plan drawings of the 100-ton oil-electric locomotive for the Long Island

cylinder, four-cycle, Ingersoll-Rand oil engines, operating at 600 r.p.m., which are located along each side of the central compartment and midway between the two trucks; and two General Electric, type TDC-6, 200-kw., 600-volt generators, directly connected to the oil engines. The generators are placed at opposite ends of the central compartment in order to secure an even distribution of the load. They supply current to four General Electric, 600-volt railway motors which are geared directly to the axles.

The oil engines

The oil engines are of the vertical, six-cylinder, four-cycle, single acting, variable speed type having direct fuel oil injection, which is effected by means of two opposed spray nozzles in each combustion chamber. Oil is delivered to the nozzles under pressure by an injection pump driven from the main shaft. Ignition is accomplished by the heat of compression only. One fuel injection pump for each engine serves all six cylinders. Fuel oil distribution is effected by a distributor timed to admit oil successively to the spray nozzles of each cylinder in the proper firing order. The engines are rated for a fuel consumption not to exceed .43 lb. per b.hp. at the rated load and speed based on oil containing 19,000 b.t.u. per lb. and having a flash point not lower than 150 deg. F. The total capacity of the fuel oil tanks is 400 gal.

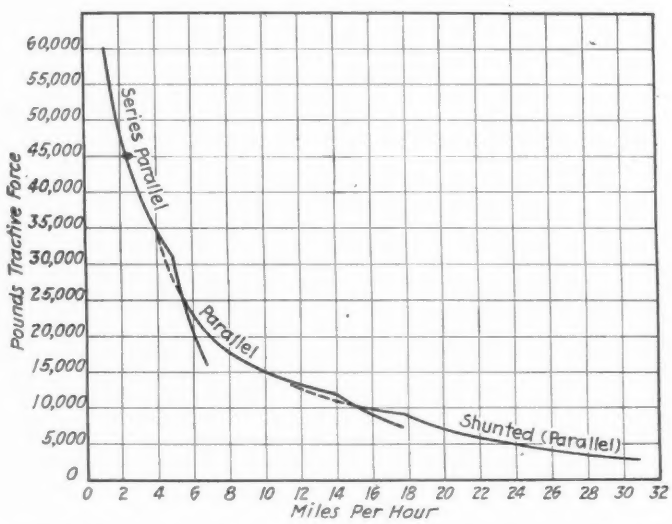
Each engine is equipped with a self-contained, force feed lubricating system. Lubricating oil is pumped to the various moving parts of the engine by a gear-driven pump located in the crank case. Provision is made to filter the oil which comes in contact with the cylinder walls before it is returned to the oil reservoir.

The cylinders, cylinder heads and combustion chambers are completely water-jacketed. Cooling water is circulated by a centrifugal pump driven from the crank shaft. The temperature of the water in the engine jackets is regulated by a thermostatic valve which controls the circulation of the cooling water from the engines to the radiators on the roof of the cab.

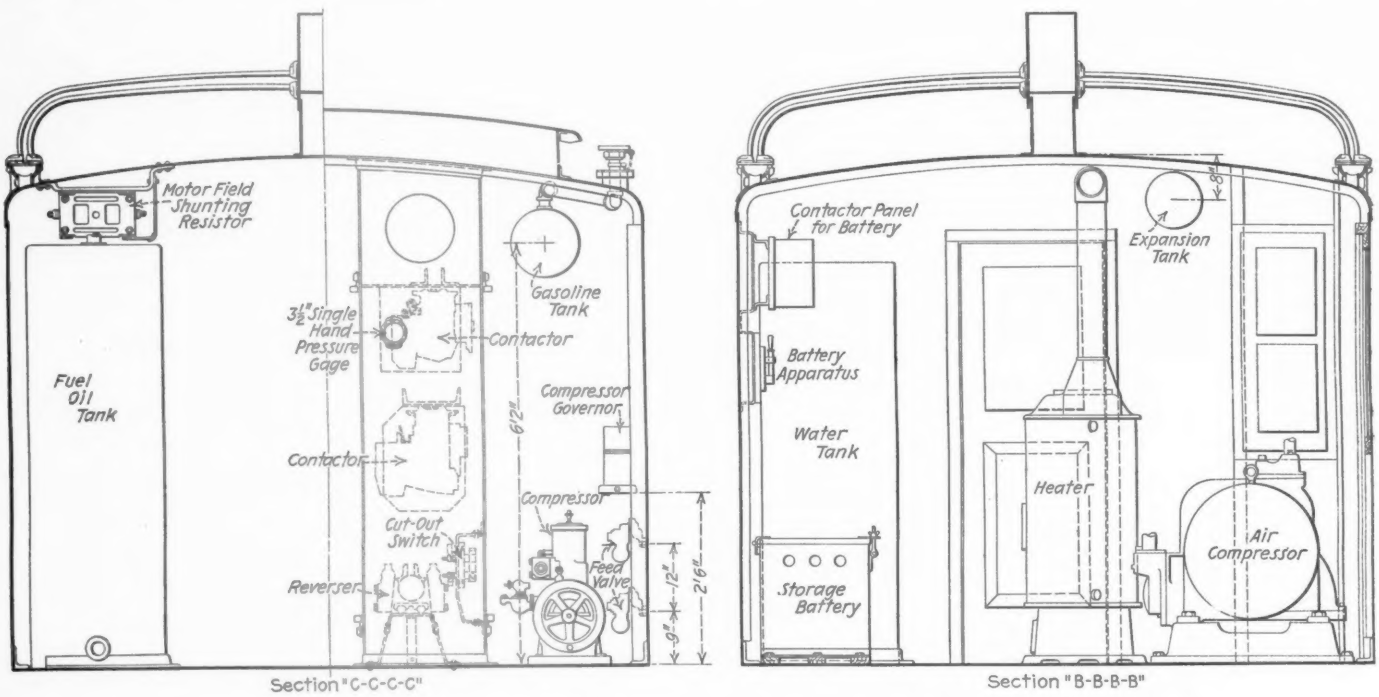
The engines are started by compressed air at approximately 200 lb. pressure, which is admitted to each cylinder in succession through mechanically operated starting valves. Compressed air for starting is provided by a Mianus two-cycle gasoline driven air compressor. Three high pressure air storage tanks are also provided for retaining a supply of compressed air for starting the oil engines.

The electrical equipment

The generators are 200-kw., 600-volt, direct current, compound-wound, and are separately excited. The voltage is regulated by the current demands of the traction motors so that the product of this current and the voltage is constant for any given engine speed. This makes it possible for the full power capacity of the oil engines to be applied to the drawbar at any speed of the locomotive, and accounts for the relatively large tractive force rating of this type of locomotive.



Speed-tractive force curve of 100-ton oil-electric locomotive



Cross section drawings through the engine compartment of the Long Island oil electric locomotive

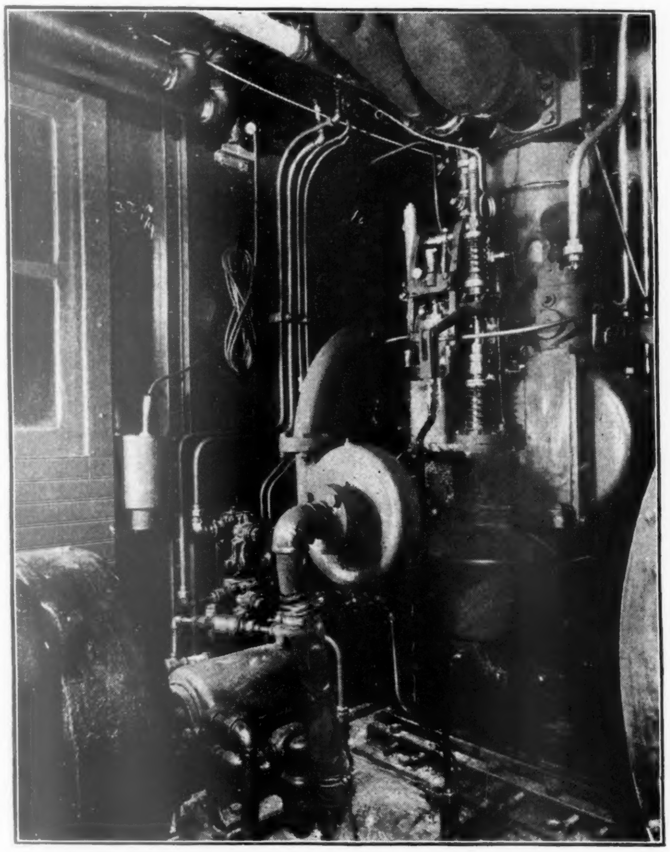
A 6-kw., 60-volt exciter is mounted on the same shaft with the main generator. A 32-volt, 100-amp.-hr. Exide Ironclad storage battery is charged by this exciter in series with one of the field windings. The exciter and storage battery circuit, which is used for lighting and

control, is controlled automatically by a switch on the main throttle of the locomotive.

Mounted on each of the four driving axles is a direct current, series motor of the single-geared, box frame, railway type, GE-69-C, manufactured by the General Electric Company. Each motor is supported on its axle by axle brackets and bearings, and by the motor nose which rests on the truck bolster. The gear ratio is 4.375, there being 70 teeth on the gear and 16 teeth on the pinion, both of which are made of forged steel.

The control system

The speed and stopping and starting of the locomotive is controlled from either end of the cab. There are two control handles. One is a throttle lever which controls the output of the engines and the other is a master controller, or electric switch handle, which connects the trac-



Interior view showing the fuel oil injection pump and circulating water pump of one of the oil engines

tion motors in series or in parallel for either forward or backward movement. No rheostats are used in the power circuit.

In operation, the electric control handle is set for either forward or backward motion, with the motors in series for speeds below five miles per hour, or in parallel for speeds above five miles per hour. This regulation of the speed and tractive force delivered is illustrated by the speed-tractive force curve shown on the chart. The position of the throttle lever determines the power delivered by the engines, which is transmitted by the generators to the motors, automatically adjusting the relation of tractive force and speed to the load on the locomotive and also automatically changing this relation to suit the varying requirements of acceleration or the grade conditions.

Referring to the speed-tractive force curve on the chart, it will be noted that the locomotive develops a tractive force of 60,000 lb. at 30 per cent, the factor of adhesion maintained to approximately one mile per hour. At ten miles per hour the locomotive develops a tractive force of 15,000 lb.

The air brake equipment consists of the Westinghouse, schedule EL-14, straight and automatic air brake. The foundation brake rigging is designed to give a total brake shoe pressure of 60 per cent of the weight on the drivers with a 50-lb. cylinder pressure. The brake cylinder is

Principal dimensions and proportions of Long Island 100-ton oil-electric locomotive, No. 401

Builders	General Electric Company; Ingersoll-Rand Company; American Locomotive Company
Type	Oil-electric
Service	Switching
Weights on drivers	200,000 lb.
Wheel bases:	
Truck	7 ft. 2 in.
Total locomotive	36 ft. 2 in.
Oil engines:	
Number	2
Type	Ingersoll-Rand, 6 cyl., 4 cycle, vertical.
Rated capacity	600 hp.
Cylinders, diameter and stroke	10 in. by 12 in.
Speed	600 r.p.m.
Piston speed	1,200 ft. per min.
Fuel	Fuel oil
Generators:	
Number	2
Type	General Electric, Type TDC-6, 200 kw. d. c., 600 r.p.m., 600 volt
Exciter	6 kw., direct connected, 60 volt
Voltage, variation	200—750 volts
Motors:	
Number	4
Type	General Electric, Type GE-69-C, 200 hp., 600 volts
Capacity of fuel tanks	400 gals.
Length over couplers	45 ft. 10 in.
Diameter of wheels	36 in.
Size of journals	6½ in. by 12 in.
Tractive force	60,000 lb. at 30 per cent factor of adhesion maintained at approx. 1 m.p.h.

18 in. by 12 in. An air compressor for providing air for braking is installed in the cab. It has a piston displacement, when working against 130 lb. pressure and at 600 volts, of 100 cu. ft. per min. It will deliver air at a pressure of 90 lb. or 140 lb. per sq. in.

The running gear consists of two four-wheel, swivel, equalized trucks, each of which is equipped with a cast steel bolster and steel side frames. The side frames are carried on semi-elliptic springs to the equalizers which are in turn carried on the journal boxes. The journal boxes are of cast steel, pedestal type with A.R.A. bearing and wedge. With the exception of the truck equalizers, axles and that part of the traction motors carried on the axle, the entire weight of the locomotive is spring supported and equally distributed over the four pair of drivers. The axles are of forged open-hearth steel and have 6½-in. by 12-in. journals.

The locomotive is equipped with Leach type D-1 air operated sanders, arranged to sand in front of the leading truck for either direction of operation.

A Peter-Smith water heater and expansion chamber is provided to keep the cooling water from freezing when the engines are not operating and for circulating hot water through the radiators in the operator's compartments. Provision is also made for circulating hot water through the radiators from the circulating system of the oil engines.

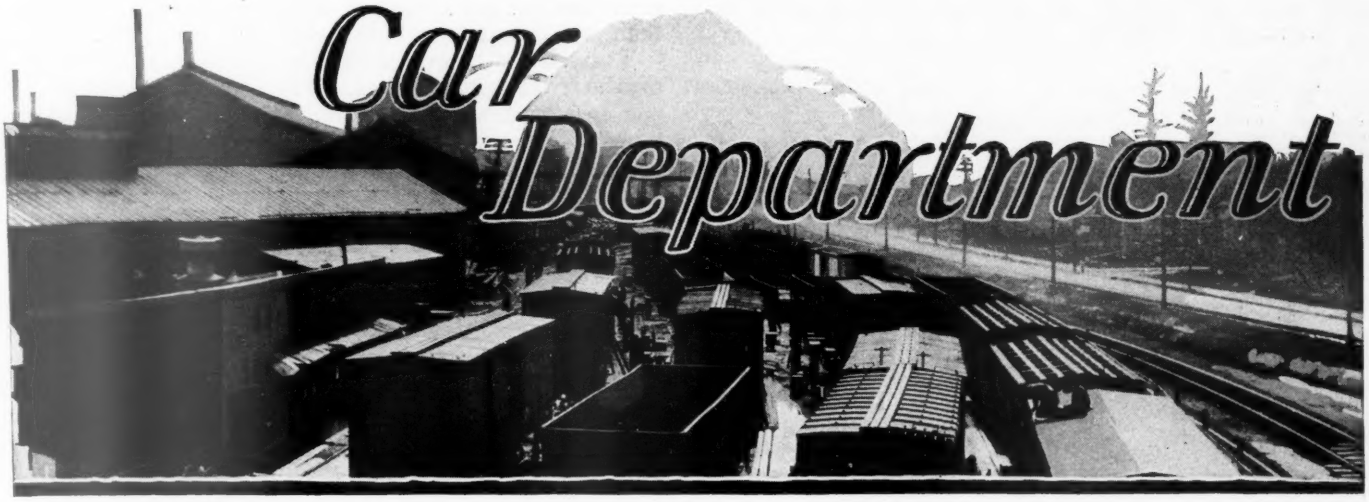
The Southern Pacific lines has issued a small booklet entitled "The Motive Power of Western Development." The story is mainly a comparison of locomotives of today and yesterday. The history begins about 60 years ago, when the Central Pacific, the parent organization of the Southern Pacific, started its historic construction of the western portion of the first transcontinental railroad and indicates what the coming of the railroad and the constant improvements in its facilities have meant in developing the west.

Examples of recent locomotives of the 2-8-2 type

Arranged in order of weight

Railroad	D. L. & W.	C. & O.	C. & O.	C. R. R. of N. J.	A.T.& S.F.	Mo. Pac.	Wabash	C.R.R. of N.J.	Wabash	N.Y.C.	N.Y.C.	U.S.R.A.	West. Pac.	So.	Can. Nat.	L. V.	Canadian Pacific	F. E. C.
Road, class or number	2,148	K-2	K-3	896	4,000	1,565	K-3	919	K-4	H-10-A	H-10-B	Heavy	325	4856	S-2B	N 5B	5,355	711
Builder	Amer.	Amer.	Amer.	Amer.	Bald.	Amer.	Amer.	Bald.	Amer.	Lima	L. & A.	A. & B.	Amer.	Amer.	Mont.	Amer.	Mont.	Amer.
Ordered or built	1,923	1,924	1,924	1,924	1924	1924	1924	1924	1924	1923	1924	1918	1924	1924	1924	1923	1923	1925
Tractive force, engine, lb.	67,700	60,300	67,700	63,000	63,000	59,800	60,400	63,000	62,000	63,500	63,500	60,000	60,300	63,000	54,600	63,000	56,200	54,700
Tractive force, booster, lb.	11,500	10,700	.....	.....	......	10,900	10,900	......	......	11,200	11,200	......	10,900	......	10,700	11,000	......	......
Cylinder horsepower (Cole)	2,824	2,683	2,824	2,624	2,624	2,493	2,558	2,624	2,624	2,824	2,824	2,493	2,683	2,624	2,427	2,624	2,342	2,434
Speed m.p.h. at 1,000 ft. piston speed	35.16	37.5	35.16	35.16	35.16	35.16	35.7	35.16	35.7	37.5	37.5	35.16	37.5	35.16	37.5	35.16	35.16	37.5
Weight of engine, lb.	362,500	358,000	355,000	343,500	343,250	343,500	341,000	340,510	335,000	334,000	337,000	325,000	327,000	325,000	326,200	325,000	321,800	296,000
Weight on drivers, lb.	276,500	268,000	271,500	254,500	348,550	250,000	248,500	254,010	246,000	245,500	246,000	240,000	245,000	239,500	236,000	239,000	240,100	221,500
Weight on front truck, lb.	25,500	31,000	31,000	26,500	32,200	29,000	31,000	26,490	32,000	30,000	32,500	28,000	24,500	26,000	29,500	29,500	26,700	25,500
Weight on trailing truck, lb.	60,500	59,000	52,500	62,500	62,500	63,500	61,500	60,010	57,000	58,500	58,500	57,000	57,500	59,500	60,700	56,500	55,000	49,000
Weight of tender, lb.	216,500	219,100	217,600	188,000	36,750	188,500	196,500	209,800	194,500	199,700	276,000	172,000	191,600	187,600	194,200	197,500	228,300	256,700
Wheel base, driving, ft. and in.	17—0	16—9	16—9	16—6	16—6	17—10	16—9	16—6	17—10	16—6	16—6	16—9	16—6	16—9	16—6	16—6	16—6	16—9
Wheel base, engine, ft. and in.	37—4	37—5	37—5	37—1	35—0	37—5	36—6	37—1	39—1	37—0	37—0	36—1	36—3	36—11	35—9	37—1	35—8	36—11
Wheel base, engine and tender, ft. and in.	73—2½	76—0⅝	76—5⅝	72—2½	72—8⅝	72—3½	71—3	76—8½	73—9½	71—6½	78—5	71—9½	73—2¾	71—8½	68—2	72—8¼	72—1½	76—11⅝
Cylinders, diameter and stroke, in.	28x32	28x30	28x32	27x32	27x32	27x32	27x32	27x32	27x32	28x30	28x30	27x32	28x30	27x32	27x30	27x32	25½x32	26x30
Driving wheels, diameter, in.	63	63	63	63	63	63	64	63	64	63	63	63	63	63	63	63	63	63
Steam pressure, lb.	200	190	200	200	200	190	195	200	200	200	200	190	190	200	185	200	200	200
Fuel	Bit. coal	Bit. coal	Bit coal	A.&B. coal	Bit. Coal	Bit. Coal	Bit. Coal	Bit. Coal	Bit. Coal	Bit. Coal	Bit. Coal	Bit. Coal	Oil	Bit. Coal	Bit. Coal	Bit. Coal	Bit. Coal	Oil
Boiler, diameter, first ring, in.	90 5/16	84½	87	84½	82	88	88	86 3/16	88	84 7/16	84 7/16	86	82	84½	76 5/16	90	78½	76⅝
Firebox, length, in.	120⅛	114⅛	120⅛	126⅛	114	114⅛	114⅛	126⅛	120⅛	114⅛	114⅛	120⅛	128⅛	120⅛	108⅛	120 1/16	120 1/16	114⅛
Firebox, width, in.	84¼	96¼	96¼	108¼	84¼	84¼	84¼	108¼	84¼	84¼	84¼	84¼	84¼	84½	84¼	90	84⅜	84¼
Tubes, number and diameter, in.	300—2	222—2	248—2	247—2¼	244—2¼	199—2¼	239—2¼	247—2¼	239—2¼	253—3¼	53—2¼	247—2¼	221—2¼	247—2¼	240—2	234—2¼	198—2¼	190—2¼
Flues, number and diameter, in.	50—5½	50—5½	50—5½	45—5½	45—5½	45—5½	45—5½	45—5½	45—5½	....	192—3½	45—5½	43—5½	45—5½	40—5⅜	50—5½	43—5½	45—5½
Length over tube sheets, ft. and in.	18—0	19—0	19—0	19—0	20—9	19—0	19—0	19—0	19—0	20—0	20—0	19—0	18—0	19—0	18—0	17—6	18—6	18—0
Grate area, sq. ft.	70.4	76.6	80.3	94.8	66.8	66.8	66.7	94.8	70.3	66.4	66.8	70.8	70.3	70.3	63.26	75.2	70.2	66.8
Coal rate, lb. per sq. ft. grate per hr. (Cole)	130	114	114.5	90	128	121	124.5	90	121	138	137.5	114.5	124	121	125	113.3	109	118.5
Steam required per hour—lb. (Cole)	58,750	55,800	58,750	54,600	54,600	51,850	53,200	54,600	54,600	58,750	58,750	51,850	55,800	54,600	50,500	54,600	48,700	50,600
Heating surface, firebox, total, sq. ft.	350	327	338	344	278	363	305	357	340	291	261	319	314	298	300	357	316	329
Heating surface, tubes and flues, sq. ft.	4,073	3,833	4,123	3,973	4,309	3,437	3,884	3,978	3,884	4,287	4,126	3,978	3,438	3,977	3,257	3,652	3,246	3,164
Heating surface, total evap., sq. ft.	4,423	4,160	4,461	4,317	4,587	3,800	4,189	4,335	4,224	4,578	4,387	4,297	3,752	4,275	3,557	4,009	3,562	3,493
Superheating surface, sq. ft.	1,112	1,173	1,173	1,050	4,162	1,051	1,051	994	1,079	1,215	2,020	993	932	1,050	885	1,074	973	991
Comb. evap. and super. surface, sq. ft.	5,535	5,333	5,634	5,367	5,749	4,851	5,240	5,329	5,303	5,793	6,407	5,290	4,684	5,325	4,442	5,083	4,535	4,484
Tender, water capacity, gallons	12,000	12,000	12,000	10,000	12,000	10,000	10,000	12,000	10,000	10,000	15,000	10,000	10,000	10,000	10,000	10,500	12,000	12,000
Tender, fuel capacity, tons or gal.	14	15	15	16	16	16	18	17	18	16	18	16	4,000	16	15	15	16	5,000
Weight on drivers ÷ weight eng. per cent.	76.1	74.9	76.5	74.0	74.6	73.0	72.8	74.6	73.4	73.5	73.0	73.9	75.0	73.9	72.4	73.6	74.6	74.8
Weight of drivers ÷ tractive force	4.08	4.44	4.01	4.04	3.95	4.18	4.11	4.03	3.96	3.87	3.87	4.00	4.06	3.80	4.32	3.79	4.27	4.05
Weight of engine ÷ cylinder hp.	128.4	133.5	125.7	130.9	136.7	143.2	133.3	129.7	127.6	118.2	119.3	130.5	121.8	123.7	134.5	123.9	137.3	121.5
Weight of engine ÷ comb. h. s.	63.7	67.1	63.0	64.0	59.9	70.6	65.0	63.9	63.2	57.7	52.6	61.5	69.8	61.0	73.8	64.0	71.2	66.0
Comb. heat. surface ÷ cylinder hp.	1.96	2.06	1.99	2.04	2.19	1.94	2.04	2.03	2.02	2.25	2.27	2.12	1.74	1.65	1.83	1.94	1.94	1.84
Tractive force ÷ comb. heating surface	12.23	11.31	12.01	11.73	10.96	12.32	11.52	11.82	11.70	9.99	10.96	11.35	12.87	11.83	12.29	12.38	12.38	12.20
Tractive force × dia. drivers ÷ comb. h. s.	771	713	757	740	690	777	737	744	748	630	691	715	811	745	774	781	781	769
Cylinder hp. ÷ grate area	40.1	35.0	35.2	27.7	39.3	37.3	38.3	27.7	37.3	42.5	42.3	35.2	38.2	37.3	38.4	34.9	33.4	36.4
Comb. heat. surface ÷ grate area	78.6	69.6	70.2	56.6	86.1	72.6	78.6	56.2	75.4	87.2	95.9	74.7	66.6	75.7	69.9	67.6	64.4	67.2
Firebox surface ÷ grate area	4.97	4.27	4.21	3.63	4.16	3.94	4.09	3.77	4.84	4.38	3.91	4.51	4.47	4.24	4.74	4.75	4.36	4.92
Firebox surface, per cent evap. h. s.	7.91	7.86	6.07	7.97	9.55	9.55	7.28	8.24	8.05	6.36	5.95	7.42	8.37	6.97	8.44	8.91	8.59	9.42
Superheat. surface, per cent evap. h. s.	25.2	28.2	26.3	24.3	25.3	27.7	24.92	26.5	21.4	38.9	45.0	23.1	24.8	24.5	24.9	21.1	27.3	28.1
Notes	a-g	a-g	a	a	b	a-d-g	a-e-g	b	a	b-g-k	a-g-k	b	a-g	a	a-g	a-g	a	a-d

Key to notes: a—Boiler diam. inside; b—Boiler diam. outside; d—Syphon; e—Feedwater heater; g—Booster; k—Type E Superheater.



Pennsylvania rebuilds steel freight cars at Enola

Units progress through the shop past repair gangs—Average daily output 36 cars—Sixty tons of material reclaimed in eight hours

On July 25, 1923, the first open top steel freight car was turned out of the Pennsylvania System Enola steel car shop located about five miles from Harrisburg, Pa. The shop was designed to repair 33 cars a day, this figure being reached in February, 1924. Since that time, the output has reached the mark of 40 cars a day, of 16 hr., which means that a car has been turned out on an average of every 25 min. The output has consistently averaged 36 cars per day. Up to January 18, 1926, 19,318 cars have been repaired in this shop.

At the present time the shop is set up to repair the Gs type low side, 100,000-lb. capacity gondolas and the Gla type, 110,000-lb. capacity, two-hopper cars. The daily output of these cars is on a one to two ratio; that is, two of the Gla type are repaired to every one of the Gs type. These cars are drawn from all over the system to receive heavy repairs. No minor repairs are made at this shop.

Organization of workmen

At present 881 men are employed at the Enola shop, including not only the repairmen actually engaged on the cars, but also the supervisors, clerks, stationary firemen, crane operators and directors, laborers, etc. The shops work three tricks, known as the A, B and C tricks, working from 7 a.m. to 3 p.m., 3 p.m. to 11 p.m. and 11 p.m. to 7 a.m., respectively. The A and C tricks are the two heavy tricks during which the repair work is done. During the B trick all the scrap is removed from the shops and enough new and reclaimed repair parts are brought in to supply the men on the A and C tricks. The gang foremen on the A trick supply the lists of material which must be placed in the shop during the B trick. During the B trick gangs work on the trucks, on the three 60-ton hydraulic gap riveters and on the side sheet, underframe and end jigs, as the shop output depends largely on these parts. The distribution of the

The Enola steel freight car repair shop, showing at the right the office and storehouse building

men on the three tricks actually engaged in repairing cars is shown in the following table:

Operation	Tricks A	B	C	Total
Foremen	1	0	1	2
Assistant foremen	2	0	1	3
Gang foremen	15	2	11	28
Acetylene cutters	6	0	6	12
Electric cutters	8	0	8	16
Acetylene welders	4	0	4	8
Reclaiming furnace	3	0	0	3
Reclaiming presses	18	0	0	18
Removing and dismantling drop doors	5	0	1	6
Repairing grab irons, ladder steps, etc	3	0	0	3
Dismantling cars	48	0	48	96
Truck repairmen	9	9	9	27
Repairing couplers and draft gears	2	0	2	4
Punch and shear	1	0	1	2
Drill press	1	0	1	2
Car oilers	2	1	1	4
Gap riveters (three machines)	9	9	9	27
Car side jigs	10	5	10	25
Drop door jigs	3	0	3	6
Longitudinal hood jig	3	0	3	6
Cross ridge sheet jig	3	0	3	6
Underframe and ends	9	8	6	23
Straightening parts on cars, applying end sills, couplers, cross ridges, sheets, longitudinal hoods, bottom floor sheets, etc	51	0	51	102
Assembling and fitting up ends, sides and floors	42	0	39	81
Pneumatic riveters	36	0	28	64
Finishing gang	16	0	11	27
Dismantling, cleaning, assembling and testing air brake equipment	15	0	14	29
Car cleaners and other work	12	0	0	12
Paint sprayers	7	0	0	7
Car stencillers	4	0	0	4

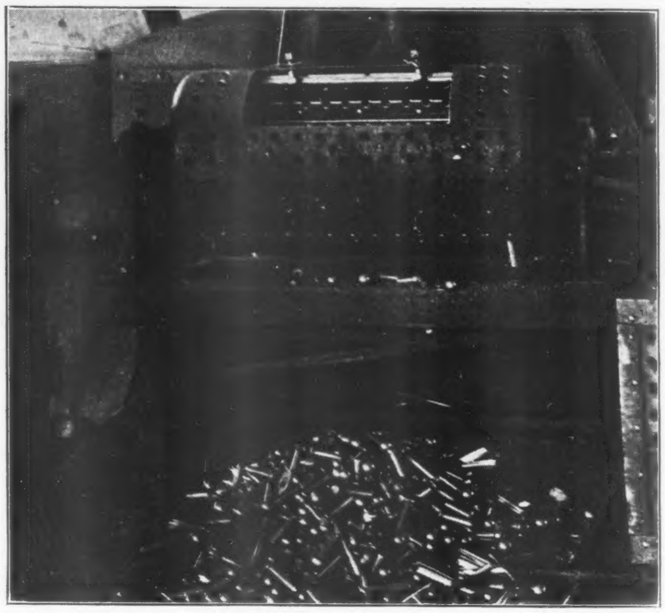
Lifting the car bodies with 15-ton cranes from the trucks after they have come from the rivet cutting shed. They are placed on benches for the dismantling gang

Following a car through the shops

The progressive steps by which a Gla, two-hopper type passes through the plant will be followed, for owing to its design, more work is required to rebuild these cars than is required to rebuild the Gs type gondolas.

Two 50-car length inspection tracks are located west of the rivet cutting shed. The cars are inspected by one inspector who marks the parts to be removed and replaced, repaired or condemned. The trucks are not inspected at this time. The inspector is followed by two men who list down all the work to be done which has been marked by the inspector. Cars are inspected only during the A trick.

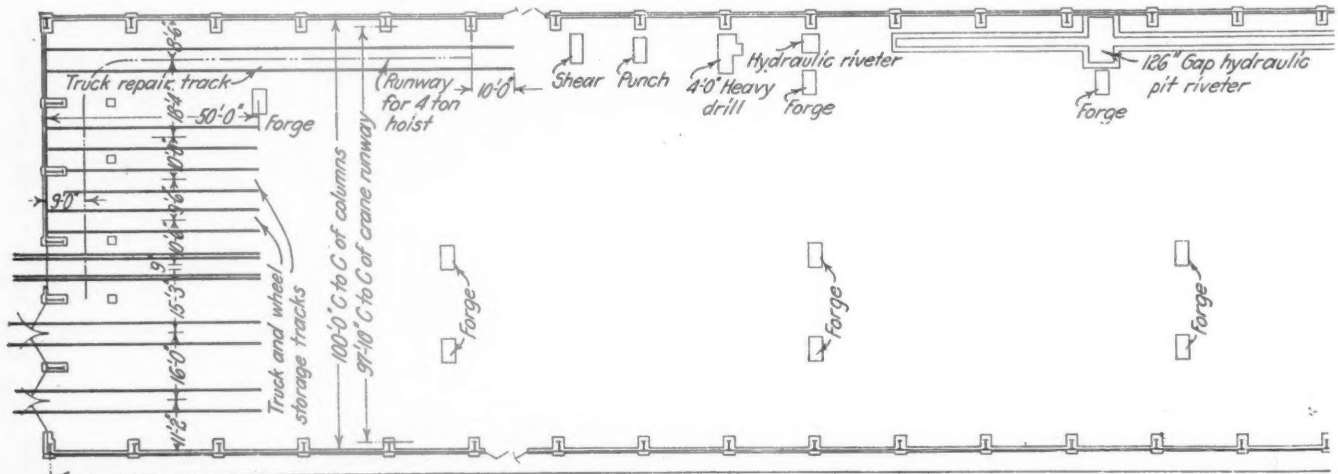
The cars are then moved to two tracks just outside of the west end of the rivet cutting shop at which point all dirt and refuse is removed by laborers. They are then pulled with an electric winch into the rivet cutting shed, which has two tracks, each holding eight cars. The shed is equipped with four electric arc welding sets and eight resistance units which travel on an overhead monorail ex-



Heated rivets which have been laid aside are reclaimed in this machine

tending the length of the shop. Two operators can work from each machine. All rivet heads on vertical and sloping surfaces are cut off with the electric arc while those on horizontal surfaces are cut off with the acetylene torch.

The cars are then pulled out of the east end of the cutting shed by an electric winch. At this point the drop



The tear-down end of the shop

doors are removed and placed on a bench where the defective parts are removed and the bent parts straightened. The doors are sent into the shop to be repaired on jigs and replaced at the proper time. After the doors are removed each car body is lifted from the trucks and carried inside the shop by a 15-ton crane and placed on benches for dismantling. There are 16 benches for this work.

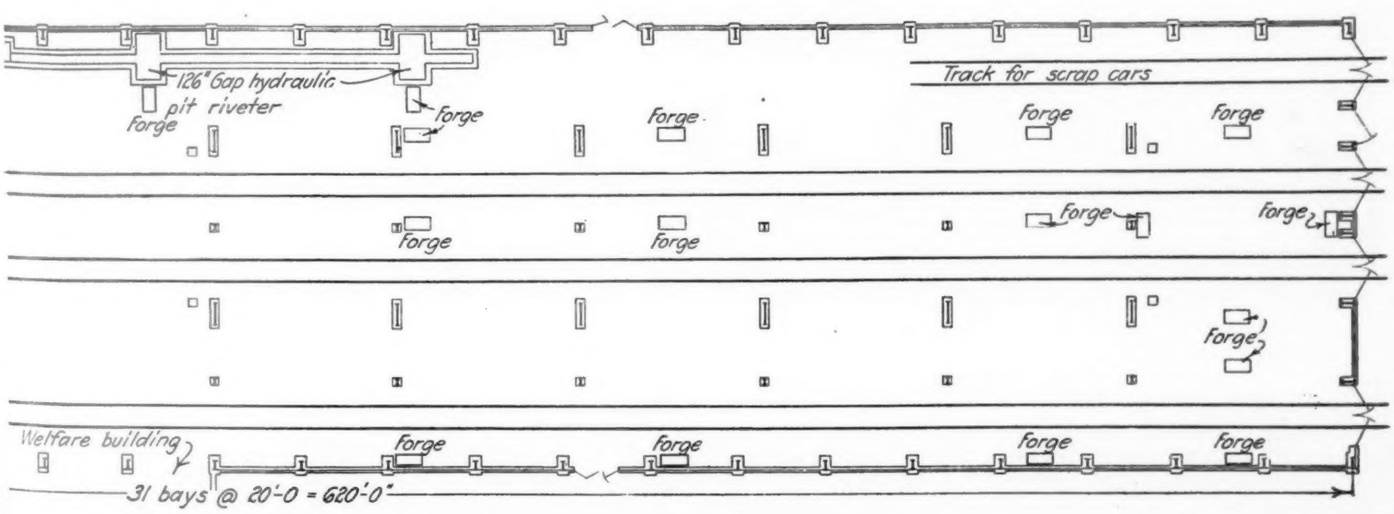
Truck repair track served by a four-ton overhead, mono-rail electric crane

The trucks are carried inside the shop and placed under a four-ton electric crane which runs on a monorail. Here the trucks are placed on a track holding five trucks which is raised 15 in. above the floor level for the convenience of the repairmen. The trucks are then completely overhauled, all parts being inspected by the gang foreman in charge. The body pins are pulled out by the four-ton crane, using a specially designed clamp. All journal packing is removed, cleaned and saturated with new oil before using again. After the trucks are repaired they are either placed under a car ready for the repair runways or are stored at the west end of the shop until needed. One laborer attached to this gang is kept busy picking up scrap material and placing it in metal boxes.

Coming back to the car body, which has now been brought into the shop, the first operation on the car is to dismantle it. This is done by the dismantling gang which backs out all the cut rivets and removes the parts marked for removal by the inspector. Sometimes there is nothing left of the car but a part of the underframe while other cars have parts of the sides and ends left standing. The foreman in charge now inspects those parts which were inaccessible to the outside inspector. He also makes the final decision as to what material is to go to the reclaiming department.

What is left of the car is then picked up from the dismantling position and placed on two repaired trucks at the head of the runways, 10-in blocks being placed over the side bearings of the Gs cars. It should be noted that the cars are run through the shop on their own trucks and not on industrial trucks. It should also be pointed out that when the car body is placed on the trucks, it is turned so that the brake shaft end is always towards the east end of the shop. The reason for this is that the air brake parts, such as the cylinders, triple valves, etc., are always on one side of the track and that the material is placed

One of the three 60-ton hydraulic gap riveting machines



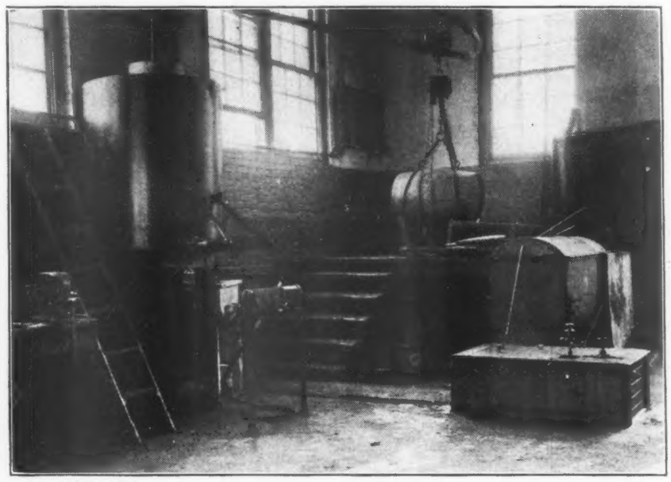
The arrangement of the set-up end of the shop

during the B trick so that it is on the side of the car to which it will be applied. This idea saves many unnecessary steps and all material has a place and is kept in that place.

There are three runways in the main shop, each of which is served by five two-ton overhead electric cranes. The cars pass through eight working positions as they move along these runways. In the first three positions all bent parts are straightened. The longitudinal hoods, cross ridge sheets, inside and outside hopper sheets, couplers, end and side sills, channels and diagonal braces are also applied in these positions. Enough rivets are

Spray painting crew which paints an average of 36 cars in eight hours

driven in these positions to secure the parts so that they will not fall off as the car is moved to the riveting position. The parts are straightened, hot or cold, on the car. To facilitate the cold straightening of parts, a unique method is used to tie the cars down to the rail when using a jack. Pieces of 90-lb. rail, 4 ft. 10 in. in length are laid in the ground at intervals at right angles to the track. They are placed right side up. Two heavy turnbuckle tie rods are used, one end of each of which consists of a clamp which fits over the ball of the rail. The other ends of both rods pass through a heavy flat piece of steel, which is placed across the end sill and held in place by nuts on the ends of the rods. The device is drawn tight by two square threaded turnbuckles. This arrangement securely holds the car to the rail. To further facilitate the straightening process, other pieces of 90-lb. rail have been placed in the same manner under the tracks but



Equipment used for mixing the paint for the spraying machines

are inverted so that the base of the rail is exposed. This surface provides a solid foundation on which the jacks are placed.

The car is then moved by hand to the fourth and fifth positions on the runway where the ends and side sheets are picked up by two-ton cranes and held in position until they are pinned and key-bolted to the cars. In the sixth position all reaming is completed. This is done by electric motors.

The seventh is the waiting position where the cars are held until the riveting gang is ready for them. They are moved from here to the eighth position by an electric winch. Here the car stands between four oil rivet heating furnaces, two on each side of the track. The riveting gang is divided into four groups of three men each.

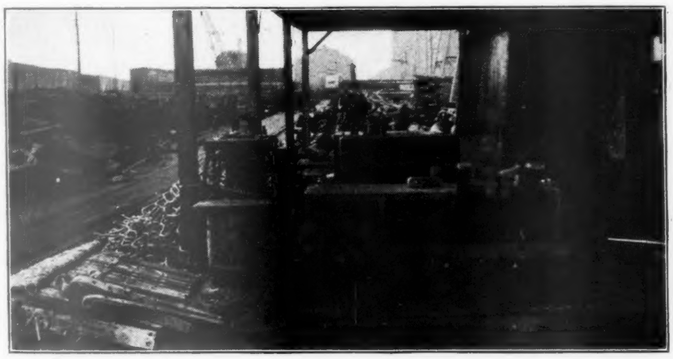
The finished product outside of the paint shop

After the riveting is completed, the cars are pulled outside the shop by an electric winch where the finishing gang applies the drop doors, door operating parts, brake shafts, steps, adjusts the coupler heights and does other miscellaneous work. All the air brake equipment is then

applied and tested. The car is then ready for the paint shop.

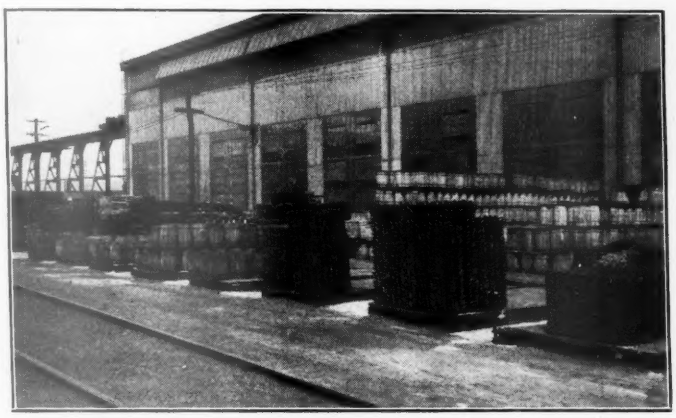
The paint shop

The cars are moved by a shifter to the paint shop which is located about one mile east of the main shop. It contains eight tracks, each holding 15 cars, or a total of 120 cars. When necessary, the cars are cleaned with substitute turpentine and wire brushed. The average workman will clean from five to six cars a day. The cars are then paint sprayed by machines. Six men are employed to spray the cars, the average workman spraying ten cars a day. The second coat of paint is applied as soon as the first coat is dry. The cars are then light weighed and stenciled as soon as the second coat is dry.



Jigs used for repairing hand holds, ladder treads and drop door hinges

The old method at some shops of marking the lines on a car for stenciling consisted of taking a notched stick and holding the lower end flush with the bottom edge of the car side and then making a chalk mark at each notch. Then the stick had to be used as a ruler to scribe the guide lines.



The orderly method of piling material outside of the shop greatly assists in placing material in the shop during the B trick

An effective marking device used at this shop as shown in one of the illustrations, has reduced the time required for stenciling by the old method by one-half. This device, called a line finder, consists of a steel frame made of $\frac{1}{4}$-in. round material welded together. Cords are properly spaced on the frame. When used the cords are first whitened with chalk after which the frame is hung over the side of the car by means of two wire hooks. The workman then simply snaps the proper strings to make the guide lines desired.

In the average railroad shop the painters carry their stencils in a tray. When they want to use them, considerable time is lost in sorting them out and dirt quickly collects among them. At Enola the stencils are hung on pegs on a rack made of light material. Thus, they are always in full view of the workmen and are kept out of the dirt.

During the year of 1925, 9,276 cars were painted in this shop and a large quantity of paint has to be mixed. By means of the equipment, shown in one of the illustrations, one man thoroughly mixes 700 gal. of paint in eight hours. This formerly required six men and then it was not fine enough to be used properly in the spraying machines. The equipment consists of an electrically driven 300-gal. mixing tank. The barrels, which contain the pigments, are lifted by a chain hoist and held in position to drain as shown in the illustration. The paint is first mixed by a screw conveyor which carries the paint to the next mixing tank which contains two cylindrical mixers. The coarse mixer consists of 48, $\frac{3}{8}$-in. round iron rods and the fine mixer, 76, $\frac{3}{8}$-in. rods, both driven at 150 r.p.m. After the paint is thoroughly mixed, which requires about 20 min., it is drawn off and passed through a strainer and then syphoned by an air driven pump into a 330-gal. storage tank shown at the left of the illustration. This tank contains an air motor driven shaft to which is attached four paddles. The purpose of this is to keep the paint continually agitated so that the heavy pigments will not settle to the bottom of the tank. The paint is drawn off through two outlets into the spray machine tanks.

This view shows the stick formerly used for laying off the stenciling lines and the frame now used—The frame for holding stencils is also shown

Outside of the paint mixing building, buried in the ground, is a 7,000-gal. linseed oil storage tank and a 5,000-gal. turpentine storage tank. Pipes lead from these tanks into the paint mixing room through which the liquids are drawn by an air motor-driven syphon pump.

All the waste and rags used about the paint shop for cleaning cars and wiping off paint are reclaimed in washing machines. The equipment for washing and drying waste and spraying machines is located directly in front of the paint mixing building. The waste washing machine consists of an iron tank, 6 ft. long, 2 ft. wide and 2 ft. deep. It is partitioned at the middle. A steam and water pipe leads into each section. In each section are three

vacuum cups and a box which contains the washing compound. The cups are moved up and down by an air motor-driven crank shaft. Each charge consists of 200 lb. of waste which is left in for four hours after which it is removed, rinsed in cold water and dried on top of a brick arch oven which is oiled fired. The furnace, which is made entirely of brick, will hold its heat for 14 hours and will dry 200 lb. of waste in eight hours, depending on weather conditions. The waste can be reclaimed at 2½ cents a pound.

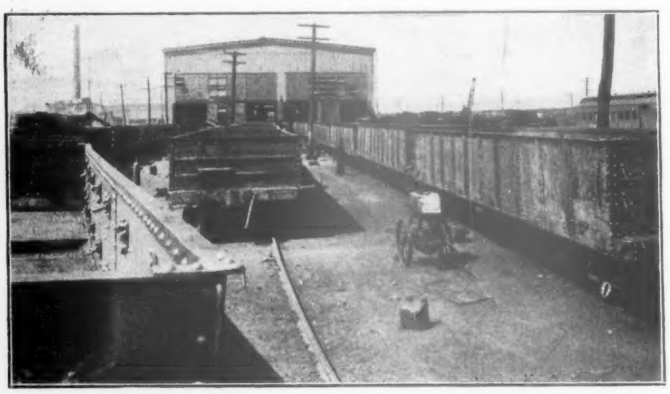
Besides using waste for cleaning the cars, 18-in. square pieces of burlap bag are used. The stores department saves up its burlap bags and sends them to the paint shop where they are cut up to the proper size and stored in the basement of the paint mixing building until needed. The spraying machines are washed out in a steel lined brick basin located to the south of the waste drier. It consists of a basin large enough to hold one sprayer. The lye bath is heated with steam in the winter and oil in the summer. It requires about two hours to thoroughly wash out a spraying machine.

Reclaiming material

After the cars are dismantled in the shop, all the material is again inspected. Those parts which can be reclaimed are brought out, during the B trick, to the reclaiming plant located at the north side of the rivet cutting shed. This department reclaims 60 tons of material in 8 hours with equipment consisting of three 30-in. and four 18-in. presses, one furnace and several jigs for reclaiming hand holds, ladder steps, drop door hinges and cross tie braces. Much of the work is straightened cold while some is heated and reclaimed.

Cross tie braces are reclaimed in large quantities. The ends are first cut off with the acetylene torch and then the remaining part is straightened under the presses. They are then held at each end in an air-operated clamp at which time new flanged ends are riveted on. Ladder steps and drop door hinges are straightened in the jigs shown in one of the illustrations.

Another illustration shows a device for reclaiming



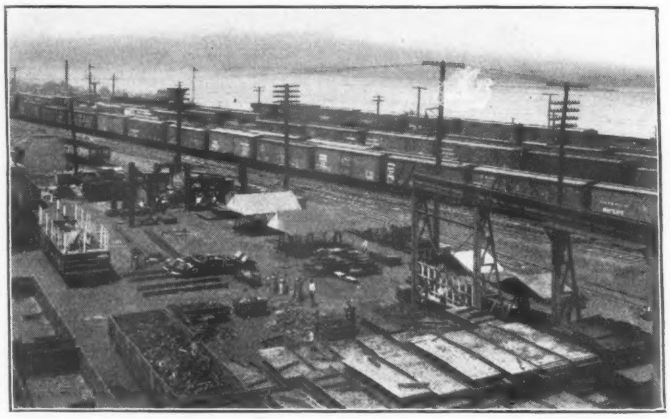
View of the east end of the shop showing the cars coming out after they are repaired, ready for the paint shop

rivets which have been heated, but for various reasons were laid aside. It consists of an old air reservoir which has 22 rows of ½-in. holes, 15 holes in each row, drilled around its circumference. The rivets are put in this cylinder together with pieces of broken reamers and the whole lot is rattled for about 20 min., with the result that all the scale is removed and the rivets are as good as new.

The plant has some by-products for which scrap credit is given, helping to reduce the costs. An average of 180,000 lb. of sheet steel scrap and 90,000 lb. of miscellaneous scrap accumulates each day the shop works, which well illustrates the magnitude of the operations. The scrap is usually loaded in the Gs type gondolas. In order to pile the scrap high in the car it was the custom in the past to use lumber as side boards. The lumber used in each car cost approximately $15. Now, scrap side stakes from Gla cars are used in place of the lumber. They eliminate the usage of lumber and are sold as part of the scrap. This means a considerable saving as three cuts of scrap are loaded each day.

Assembling car parts on jigs

The assembling and riveting of the car sides is an operation in itself. The car sides are bolted together and



View of the straightening and reclaiming plant where 60 tons of material are reclaimed in eight hours

reamed on a jig made of angle irons. There are two of these jigs which are kept busy during all three tricks. Five men on a jig build up from 16 to 18 sides in eight hours. The jigs are served by a revolving electric jib crane. The sides are then moved to the hydraulic gap riveters by electric cranes. The gap riveters are also served by a mono-rail electric crane.

Jigs are used for building up center sill splices, drop doors, applying the inside hoppers to the longitudinal hoods, car ends and web plates. Some of these jigs are outside of the north side of the building. An industrial track runs along this side of the building and the built-up parts are placed on trucks and run in the shop under the cranes, which pick them up and place them at the station assembling these parts. This track relieves the 15-ton shop cranes from a great deal of work and generally speeds up the operation. This arrangement of the jigs on the outside saves considerable floor space in the main shop. The jigs are under cover on the outside so as to protect the workmen.

Saving of floor space

Floor space is conserved as much as possible. At various points in the shop, metal scrap boxes are placed under the floors. A small trap door about 12 in. square is removed and the small scrap material is passed through the opening. When the boxes are full, they are removed by a crane through a large trap door and another immediately put in its place.

Although the work in a steel car repair shop is probably more hazardous than that in any of the other various railway shops, there were only 18 accidents resulting in lost time at Enola during the last eight months of 1925. This commendable record was obtained as the result of a unique safety first campaign which will be described in detail in a later issue of this magazine.

Car orders placed during 1925

Freight equipment ordered is considerably less than 1924—Passenger car requirements the same as in previous years

THE orders for freight cars placed during 1925 for service in the United States total, according to compilations of the Railway Age, 92,816 cars. This figure, compared with 143,728 ordered in 1924, with 94,471 in 1923, and with 180,154 in 1922, shows that the 1925 total was considerable below normal. During the greater part of the year, the freight car market was practically stagnant. It later revived to the extent that about one-half the year's orders were placed after October 1. On the other hand, the orders placed for passenger cars during 1925 for service in the United States totaled 2,191. This, compared with 2,554 in 1924, with 2,214 in 1923, and with 2,382 in 1922, shows that the requirements of the railroads for passenger car equipment have been practically the same since 1921, when only 246 passenger cars were ordered. These totals do not include the orders for rail-motor cars, details concerning the orders for which are incorporated in another article in this issue.

The orders for freight cars placed by Canadian purchasers with Canadian builders totaled only 642, this light business being similar to that in 1921 and 1922 as shown in Table I.

None of the Mexican railways placed orders for freight equipment during the past year, but a considerable number of cars were exported to oil and mining companies in South and Central America. The International Railways of Central America placed orders for 306 cars of miscellaneous freight equipment, and the Consolidated Railroads of Cuba ordered 325 freight cars last year. These two orders were the largest exported for railroad service. The total export business amounted to 2,138 cars.

Table I—Orders for freight cars since 1918

Year	Domestic	Canadian	Export	Total
1918	114,113	9,657	53,547	177,317
1919	22,062	3,837	3,994	29,893
1920	84,207	12,406	9,056	105,669
1921	23,346	30	4,982	28,358
1922	180,154	746	1,072	181,972
1923	94,471	8,685	396	105,552
1924	143,728	1,367	4,017	149,612
1925	92,816	642	2,138	95,596

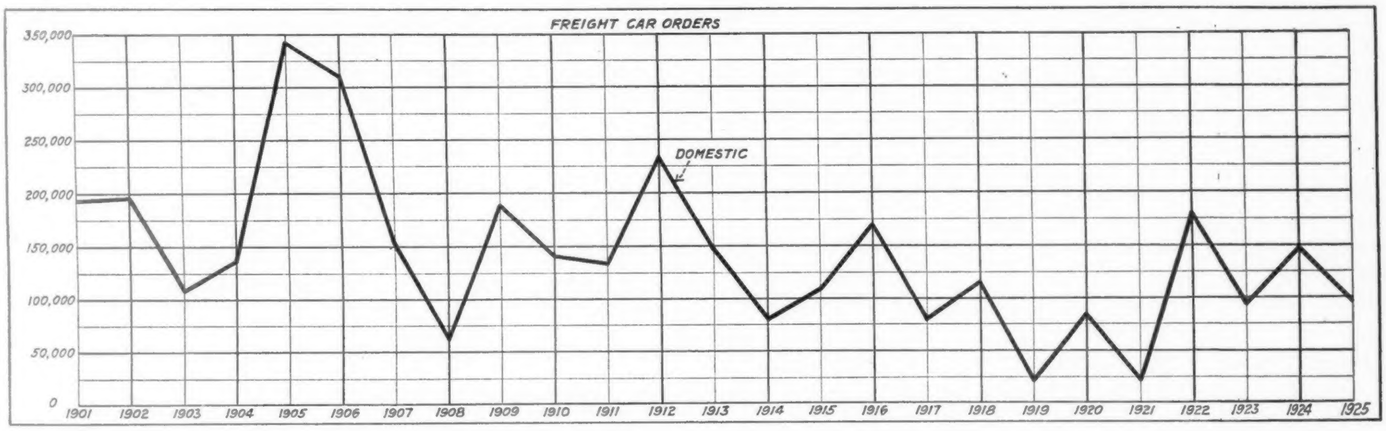


Chart showing the number of freight car orders placed each year from 1901 to 1925

Freight car production in 1925—as distinguished from orders placed—totaled 105,935 cars as compared with 113,761 cars in 1924. Orders for the first nine months of the year totaled only 45,000 cars, or an average of but 5,000 cars a month. In June and July orders were reported for about 800 cars each.

During the entire year the railroads continued to report a substantial surplus of cars in good order. The surplus at its lowest point did not fall below 100,000 cars, although in October, the largest volume of business in the history of the railroads, measured in net ton-miles, was moved. Table II shows the number of freight cars built for domestic and foreign service in the United States and Canada since 1913.

The largest freight car order placed during the year 1925 was by the Baltimore & Ohio, which ordered a total of 10,100 cars. The Chicago, Milwaukee & St. Paul was also a heavy purchaser of freight equipment, ordering a total of 6,500 freight cars, of which 1,000 were single-sheath automobile cars and 3,000 single-sheath box cars, all of 80,000 lb. capacity. The Cleveland, Cincinnati, Chicago & St. Louis ordered a total of 4,300 freight cars of which 1,500 were gondolas of 110,000 lb. capacity. Other large purchasers included the Delaware, Lacka-

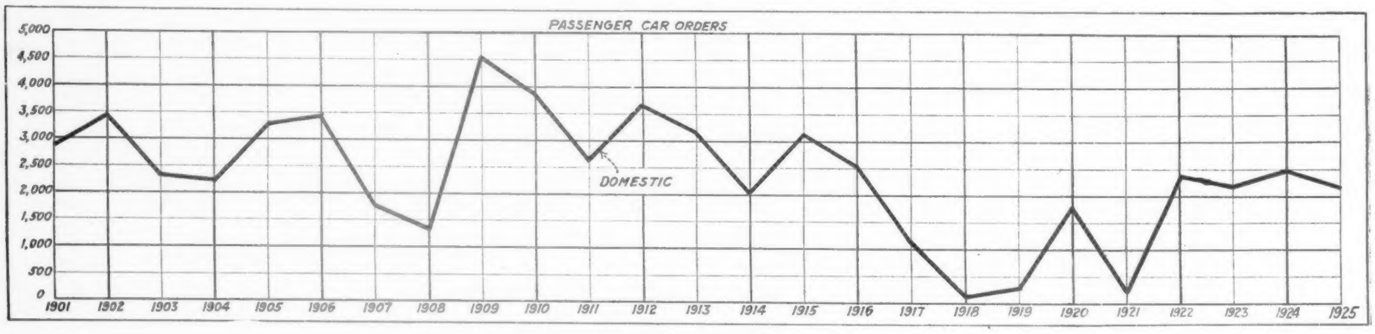
Table II—Freight cars built in 1925

	United States	Canada	Total
Domestic	105,935	.....	.....
Foreign	3,010	.....	.....
	108,945	.....	.....

	United States			Canadian			Grand total
	Domestic	Foreign	Total	Domestic	Foreign	Total	
1913	176,049	9,618	185,667	22,017	.....	22,017	207,684
1914	97,626	462	98,088	6,453	.....	6,453	104,451
1915	58,226	11,916	70.142	1,758	2,212	3,970	74,112
1916	111,516	17,905	129,421	.....	.....	5,580	135,001
1917	115,705	23,938	139,643	3,658	8,100	11,758	151,401
1918	67,063	40,981	108,044	14,704	1,960	16,664	124,708
1919	94,981	61,783	156,764	6,391	30	6,421	163,185
1920	60,955	14,480	75,435	.....	.....	.....	.....
1921	40,292	6,412	46,704	8,404	745	9,149	55,853
1922	66,289	1,126	67,415	458	100	558	67,973
1923	175,748	2,418	178,166	.....	.....	.....	.....
1924	113,761	1,141	114,902	1,721	.....	1,721	116,623
1925	105,935	3,010	108,945	.....	.....	.....	.....

wanna & Western, 1,475; the Great Northern, 1,827; the Louisville & Nashville, 3,250; the Missouri Pacific, 3,000; the New York Central, 5,650; the Norfolk & Western, 3,528; the St. Louis-San Francisco, 4,000; the Southern Pacific, 3,800; the Union Pacific, 1,026 and the Wabash, 2,039. The largest order placed in Canada was for 525 by the Canadian National.

The types of freight cars ordered for service in North America are shown in Table III. None of these cars are of unusual capacity. The railroads ordered more box cars than any other type, of which there were a total of 31,037, or 33.2 per cent of the total ordered last year. Of the open top cars, there were more gondolas ordered than any other type. Orders placed in 1925 for gondola cars totaled 23,317, or 25 per cent of all the freight cars ordered.



Passenger car orders, 1901 to 1925

Comments on design

After many vicissitudes of letter ballots, recommendations and modifications, the A. R. A. single-sheathed box car has been approved as recommended practice. Two designs of the proposed A. R. A. standard double-sheated box car were submitted to letter ballot and adopted by a large majority. A number of steel sheathed cars with wood lining have been in service for some time and the committee is awaiting service reports before resubmitting the question of adopting these cars as standard to letter ballot. The designs covering steel frame cars with wood sheathing and lining of 40 and 50 tons capacity were the ones adopted as recommended practice.

Table III—Types of freight cars ordered in 1925 for use in the United States and Canada

Type	Number	Per cent
F.—Flat and logging	3,359	3.5
G.—Gondola	23,317	25.0
H.—Hopper	7,546	8.2
R.—Refrigerator	7,358	7.8
S.—Stock and poultry	3,156	3.4
T.—Tank	4,582	4.9
X.—Box	31,037	33.2
Automobile	10,016	10.7
Ballast, dump and ore	1,873	2.0
Not classified	660	.7
N.—Caboose	571	.6
Total	93,475	100.0

Passenger car orders

Railways in Canada reported orders for only 50 passenger train cars. This is the smallest number of cars that have been ordered by Canadian railways since 1918, as shown in Table IV.

A total of 76 passenger train cars were ordered for export of which 32 were for the International Railways of Central America and 27 were for the Havana Central, Cuba.

The production of passenger train cars for domestic service in the United States totaled 2,363, as compared with 2,150 in 1924. While it is true that the railroads have had substantial losses in their passenger traffic, this loss has been in the short-haul business. The railways have reported satisfactory long-haul passenger traffic, and the orders for 1925, as shown in Table V, include a total of 535 sleeping, parlor and chair cars, or 23.9 of the total passenger equipment ordered. In addition, the railroads ordered a total of 112 dining cars or 5 per cent of the total, which added to the preceding figure, makes a total of 647, or 28.9 per cent of the total cars ordered for service in long-haul passenger traffic. This figure, of course, does not include the number of coaches that may have been ordered for long-haul business.

The largest single order for passenger equipment was placed by the Pennsylvania when in July it distributed orders for 357 cars, of which 122 were baggage and express cars, among various builders. The Pennsylvania's passenger car orders for the year totaled 375. Early in December, the New York Central placed the year's second largest order, a total of 274 cars. This road was also in the market at various times during the year and placed orders for a total of 418 passenger train cars. Orders placed by neither of these roads, however, exceeded the total of the new equipment authorized by the Pullman Company, which amounted to 568 cars. Referring to Table V, it will be noted that only 10 express refrigerator cars were ordered in 1925 as compared with 410 in 1924, and 400 in 1923. Table VI shows the number of passenger cars built in the United States and Canada for domestic service and for export.

Table IV—Orders for passenger cars since 1918

Year	Domestic	Canadian	Export	Total
1918	9	22	26	57
1919	292	347	143	782
1920	1,781	275	38	2,094
1921	246	91	155	492
1922	2,382	87	19	2,488
1923	2,214	263	6	2,483
1924	2,554	100	25	2,679
1925	2,191	50	76	2,317

Table V—Types of passenger equipment ordered for use in the United States and Canada

Type	1923	1924	1925
Coach, combination, passenger, etc.	736	952	650
Multiple unit coaches and trailers	...	...	82
Sleeping, parlor, chair, etc.	488	543	535
Dining	76	133	112
Baggage, express, mail	415	555	739
Express refrigerator	400	410	10
Milk	323	12	80
Horse	16	34	16
Private, business, miscellaneous	15	15	17
	2,469	2,654	2,241

Developments in 1925 tend to provide increased comfort for passengers

Competition for passenger traffic has been an incentive to the railroads to improve their facilities for travelers,

especially for long-hauls. Many of the "crack trains," have been re-equipped during the past year. Special attention has been given to the interior arrangement. There has been a tendency, especially in dining and parlor car equipment, to eliminate all moulding as much as possible and to finish the interior walls with such material as plain Cuban mahogany without any inlay or ornamentation. A feature of many of the cars of this type is the lighting arrangement and design of the fixtures. Evidence that considerable attention has been paid by the designers to the necessity of having the lighting fixtures harmonize with the scheme of interior decoration is shown in the cars that have been built during the past year.

Table VI—Passenger cars built in 1925

	United States	Canada	Total
Domestic	2,363	.....	.....
Foreign	50	.....	.....
	2,413	.....	.....

Year	United States Domestic	United States Foreign	United States Total	Canadian Domestic	Canadian Foreign	Canadian Total	Grand total
1913	2,559	220	2,779	517	.....	517	3,296
1914	3,310	56	3,366	325	.....	325	3,691
1915	1,852	14	1,866	83	.....	83	1,949
1916	1,732	70	1,802	37	.....	37	1,839
1917	1,924	31	1,955	45	.....	45	2,000
1918	1,480	92	1,572	1	.....	1	1,503
1919	306	85	391	160	.....	160	551
1920	1,272	168	1,440	....	.....	....	.....
1921	1,275	39	1,314	361	.....	361	1,675
1922	676	144	820	71	.....	71	891
1923	1,507	29	1,536	....	.....	....	.....
1924	2,150	63	2,213	167	.....	167	2,380
1925	2,363	50	2,413	....	.....	....	.....

The demands on the railroads by the increase in suburban business has also required a special study of the equipment used in this service. The outstanding developments in suburban cars in 1925 were incorporated in those built for the Boston & Albany. These cars are now in service on the main line and the Highland branch between Boston, Mass., and Riverside and have a seating capacity of 100. The features in the design of these cars are the ample space provided at each end of the car for standing room, the wide end doors and wide steps with four treads. The seats have no arms which aids considerably to the ease of passage through the aisle and entrance into the seats. A description of these cars was published in the May, 1925, issue of the *Railway Mechanical Engineer*.

Decisions of the Arbitration Committee

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Responsibility for bulged car sides

The Bessemer & Lake Erie, on December 18, 1923, furnished an inspection certificate to the Pittsburgh, Shawmut & Northern, requesting disposition of P. S. & N. car No. 6446 under A. R. A. Rule 120, the car being reported damaged in ordinary service, because it had a bulged side when picked up at Pittsburgh Junction which became gradually worse in service so that when it arrived at North Bessemer it was no longer safe to clear adjoining tracks. The car owner declined to furnish disposition on the ground that the B. & L. E. did not furnish specific information as to conditions under which the damage to the car occurred as provided in the footnote of A. R. A. Rule 43. An inspection of the car was made by a representative of the car owner who contended that the nature of the defects indicated unfair usage or derailment, which would probably bring the case under Rule 112. The handling line pointed out that the car was 16 years old and that the records did not show that it had ever received any important repairs except for the application of draft arms. It maintained that the car was moved under load in a train which had no derailment or unfair usage to this or any other car. The handling line further stated that it had complied with all the requirements of Rule 43 by explaining to the owner that the car bulged in ordinary service between specified points on the road. The car owner stated that the B. & L. E. did not furnish sufficient information relating to the origin of the damage and as the owner had made extensive repairs to the car five months prior to the time it was reported for disposition, it decided to inspect the car. Following this inspection, the handling line failed to furnish a statement explaining fully how the damage occurred, to which the owner insisted it was entitled under the footnote of Rule 43, but suggested an inspection by some disinterested car inspectors. The owner declined to be a party to this suggestion but such an inspection was conducted by the handling line in conjunction with two neutral roads. Two different statements furnished by the handling line indicated that its representatives were confused in their own minds as to how or when the damage occurred.

The Arbitration Committee rendered the following decision, "The handling line, having failed to furnish the car owner the information required by the note under Rule 43, should assume responsibility. Arbitration Cases 1219 and 1283 are parallel."—*Case No.* 1344, *Bessemer & Lake Erie vs. Pittsburgh, Shawmut & Northern.*

Responsibility for the application of wrong triple valve

On November 2, 1922, the Louisville & Nashville rendered its repair cards to cover the repairs to San Antonio & Aransas Pass car No. 8191. Among other items covered by repair cards were the following:

N. Y. F.—1 triple R. & R., out of date.
Cyl. C. O. T. & S.—Rule 60, S.A.A. P.6-21 at Ykm.
Not stencilled for style valve. Date built, April, 1913.

On December 3, 1922, the card was returned to its owners at which time a joint evidence card was made stating that the New York F-1 triple valve should have been made a Westinghouse K.-1 triple valve. The car owner after correcting the wrong repairs originally made, submitted to the Louisville & Nashville, the joint evidence together with the billing repair card with the request that a defect card be furnished for the application of a wrong triple valve. The Louisville & Nashville declined to issue a defect card on the ground that, inasmuch as the repair card included information showing that the car was not stencilled to maintain a K-1 triple valve and that the joint evidence card did not show that the car was so stencilled, the evidence not conclusive that wrong repairs were perpetuated. The car owner contended that it was not a requirement of the interchange rules to include on joint evidence cards, properly secured under Rule 12, information showing the stencilling on cars to support the evidence of a disinterested inspector that improper repairs existed. The information to the effect that the car was stencilled was, however, later added to the joint evidence card, but the Louisville & Nashville did not consider this addition to the joint evidence card several months after the improper repairs were corrected as acceptable or as invalidating its original record

of repairs which makes special mention that the car was not stencilled for the type of valve standard to the owner's car.

The Arbitration Committee rendered the following decision: "The Louisville & Nashville Railroad is responsible for the wrong triple valve, in accordance with the joint evidence furnished."—*Case No.* 1346, *San Antonio & Aransas Pass vs. Louisville & Nashville.*

The lubrication of car equipment*

A discussion of methods and practices found effective in reducing hot box troubles—Emphasis on trained forces

By G. E. Dailey

Supervisor of lubrication, Chicago, Burlington & Quincy, Chicago

WE are all agreed on the fundamental principles necessary to obtain desired lubrication and reduce the number of hot boxes. But are we pursuing the right course? Hot boxes are not eliminated at meetings or in offices, but in the train yard and on the repair tracks. If the number of hot boxes are to be decreased and the cost incident thereto lessened, we who are supervising lubrication must go out into the field with the oilers, packers and inspectors; teach them if necessary the proper methods to follow, not only during the time an epidemic is present but all the time, constantly keeping before them what a hot box really costs and not lose sight of the fact that we should make the oiler feel that he is an important cog in this machine. I recall when the oiler or packer was considered non-productive, or in a class with the common laborer, and invariably during the time of retrenchment, these men were about the first to be reduced. This false impression is disappearing fast, and we realize these men are highly productive.

A well-trained force of oilers and packers will reduce the number of car men on a repair track who are engaged in changing wheels on cars that have been set out on account of cut journals caused from hot boxes. Hot boxes may result from a number of causes but the most common ones which we meet with every day are defective wedges, top of oil boxes worn, cracked bearing linings, and packing settled or rolling away from the back or fillet ends of the oil boxes.

Oil of a good quality and packing that will stand up to the journal is necessary if good lubrication is to be obtained. With these furnished, the cause of hot boxes in most cases is improper maintenance. We expect the oiler in transportation yards to condition the boxes so trains can be moved with prompt dispatch. The point of origin is the proper place to service treat a journal box, and the kind of treatment given is an important factor in effecting good lubrication.

Method of treating boxes

I recommend the following treatment of boxes, which has been the means of increasing the miles per hot box:

Remove the front plug, place the packing iron in the bottom corner of the box between the metal and packing; pushing the iron two-thirds of the way back, turn it towards the journal and then push it back to the extreme end of the box. This replaces the packing that has rolled or settled away from the journal. Pull the iron out and repeat on the opposite side of the box. Place the iron in the box on top of the packing and level it up, working the packing down to the center of the journal. Finish the box by tucking the packing snugly against the collar. Replace the front plug in a loaf form, avoiding the use of a knife so it will not be interlaced with the main body of the packing. This treatment requires about five minutes to the side of a car and is confined to cars that are at freight houses, elevators, coal mines, and those that are not made up in trains.

At intermediate or passing stations where trains are on hand but a short time, the ordinary running inspection only can be made; this, however, should be done in a thorough manner. Lids must be raised and the packing iron placed in the back end of the box to ascertain if the packing is in place. Under no condition pass up a box that has a hole in the packing at the back end. We all agree that it would be best to set the car out in preference to letting it go forward in this condition, as a hot box is sure to develop.

Boxes with the packing riding against the top of the box and against the brass are very common conditions. If we would ask the question, "Why do we lag a steam pipe or put on an overcoat," our answer would be, "To keep the heat in." Knowing this to be a fact, why do we permit overpacking of oil boxes. I have found hundreds of boxes where the packing was wedged tight against the box on both sides of the journal, and many up to the top of the box, obstructing the only possible means to radiate the heat generated by the journal. You no doubt have seen oilers adding small balls or shoving short pieces of packing into the corner of the box in order to fill up a hole in the packing. This practice should be discouraged, and in the event it is necessary to use packing, use a piece the thickness desired and work it into the box in the same manner that would be done if a box were entirely repacked. Working it in uniformly not only takes care of the missing packing, but will also raise it to the desired height. Small bits of packing carelessly applied are easily dislodged, and in a short time it is rolling against the sides of the journal, serving as a wiper and destroying lubrication.

The greatest evil that we have to combat at the present time is the piece of packing that is placed lengthwise of the journal in a twisted or rope form and not connected with the main body of the packing. This is always dry and, resting against the journal at the rising side, constantly serves as a wiper for the oil that is picked up from saturated packing under the journal. I believe everyone knows, or should know, that packing

*Abstract of an address presented at the regular monthly meeting of the Western Railway Club held at the Hotel Sherman, Chicago, on January 18.

placed in this manner, since it is not being interlaced with the packing under the journal, never attracts any of the oil from the bottom of the box and invites a hot box.

We have too many oil box lids defective to such an extent that it is impossible in many cases to open them. When an oiler comes upon a box in this condition, which cannot be opened, he will as a rule pass it up for the time being, fully intending to return and give it attention after he has worked the balance of his train, but before he has an opportunity to get back, the train has departed. If it runs hot, it is up to the trainmen out on the road, who will set the car out in preference to delaying the train unreasonably. A talk with almost any trainman will bear this out and emphasize the importance of repair track forces maintaining box lids in first class condition.

Proper tools are essential to carry on this work. No oiler or packer should be permitted to work with a packing iron having a blade of less than 14½ in. in length, so he can get to the back end of any size oil box. It will surprise one how many irons are in use that will not reach the back end of the box. Packing hooks and a bucket should also be carried. Without a hook, improperly packed or disarranged packing cannot be given proper treatment. In my opinion this explains to a certain degree the large number of overpacked boxes in service today.

The oiler, being a busy man, concentrates on the condition of the packing, and is apt to overlook other mechanical defects that contribute to hot bearings. Therefore, when trains reach inspection points the inspector should lift all lids and inspect for low, broken brasses and slipped lining, and see whether or not the wedges are in place. An inspector should feel the ends of the journals with his bare hand and not pass along the train merely feeling the tops or sides of the boxes, as is so often done.

A dry spot on the journal end gives warning

An approaching hot box usually gives warning through the dry spot developed at the collar end of the journal around the lathe center hole. Hot boxes in many cases are a long time in the making. Defects under the brass and under the packing which cannot be detected through ordinary inspection run a long distance before the journal becomes hot enough to smoke, but the excessive friction causing heat will go to the center and out the end of the journal, burning the oil around the center, which produces a dry spot, the best tell-tale known of a prospective hot bearing. When a journal is found in this condition, do not pass it up. Stop and pull the packing; carefully examine it to see if it is glazed or dry, especially at the fillet end; examine the brass on the wedge where it will be found in most cases that either a waste grab has just started or a wedge is carrying all the weight either at the back or front of the journal, and in many cases the entire surface of the wedge is worn flat. Any one of these conditions will produce a dry center, and in a short time a hot box.

The salt and pepper treatment, or poking at the front of the box is responsible for a large per cent of our hot boxes, and must be discouraged if we expect to improve the situation.

Assuming that the oil box is filled with well lubricated packing resilient enough to stand up to the journal, it should run indefinitely before it becomes necessary to apply any additional packing. However, before the car leaves the terminal, the oiler will give the front plug a poke and partly wedge it under the journal. Perhaps the oiler may add a little more plug if he deems it necessary, as the average man feels that a plug large enough to cover the collar is necessary. This same treatment will take place four or five times every 1,000 miles. Finally the packing is so tight that it glazes and prevents capillary attraction of the oil to the journal.

The use of free oil is a subject of frequent discussion and various opinions. Oil companies tell us, and I think we all agree, that only a very thin film of oil gets between the bearing parts, which prevents them from coming in contact with each other, no matter how much oil is placed in the box. However, a study of packing conditions will show that about one box out of every twelve could stand a little oil, especially on cars that have been standing around for a few days. It is my opinion that a little oil used judiciously will prevent many hot boxes and ultimately reduce the cost of lubrication. It is true that boxes in this condition should be repacked with fresh packing, but anyone familiar with train yard operations will readily see how inconsistent this is, if we expect to get over all the boxes.

Free oil test successful

At a terminal where a through service treatment was possible, the free oil can was given a test, and I am advised that the cars that were set out of trains en route on account of hot boxes were reduced from an average of about 250 cars per month to 45. The cost of the free oil during this test amounted to approximately 50 cents per day. These are train yard problems and will effect a reduction in hot boxes if religiously followed.

Annual re-packing of journal boxes helps solve the hot box situation. Cars that are in service with a date of last repacking twelve months old should be placed on repair tracks, the packing pulled and thoroughly renovated, the oil boxes, brasses and wedges examined and the trucks tightened up.

A campaign of this kind on any railroad will bring out defects such as brasses with cracked lining, flat or broken wedges, and worn tops of oil boxes. Notwithstanding that these same cars may be running cool at the time, when put under a maximum load they will fail. The wedge plays a very important part in lubrication and I feel that the sooner we scrap worn flat wedges, the quicker we will get relief.

The top of a new A. R. A. wedge has a 78-in. radius. This places the weight assigned to the journal on the center of the wedge, which is distributed equally over the brass. Lack of the oscillating motion, for which the wedge is designed, will cause the brass to bind, producing excessive friction and eventually a hot bearing. The same is true when the top of the oil box is worn. All wedges should be positioned by the lugs in the oil box, which are for that purpose. Never use a bar or other tool to force them in place if it can possibly be avoided. Too often brasses are changed and a worn flat wedge reapplied; the latter no doubt is the original cause of the hot box.

Walk up and down almost any repair track and you will find at least 25 per cent of the wedges unfit for service. All worn out or defective wedges should be broken at the time of removal, so that it will be impossible to reclaim. Unless this is done my experience has been that most defective wedges work back into the stores department.

Brasses must have a smooth surface, broached and free from hard spots. I often wonder what the result would be if we would fit other bearings as we do the freight car brasses. It is not unusual to see brasses put on the journal and no attention paid to see whether they are getting any kind of a bearing. Brasses are applied with bad nicks or rough spots, and in many cases without any oil. I believe if a little more time were taken and a crown bearing obtained about two inches wide the full

length of the bearing an improvement would be noticeable.

The foreman or wheel checker should personally see every wheel change made and know that the journal is perfectly smooth and free from abrasions, that brasses and new accurately fitted dust guards applied. Wheels on the same axle must be of the same diameter and mounted to center. Do not have bent axles or tapered, undersize or oversize journals. Journal turning lathe operators can cause no end of trouble if the journals are turned taper with rough collars or fillets. These conditions are not intentional but often due to eagerness to get output.

The finishing cut taken on a journal should be a very light one, so that it can be rolled smooth, free from scabs or burs which are visible if closely inspected. When these scabs separate from the journal and remain between the hearing contacts, they will cause excessive friction and overheat the bearing. When an oil box is applied, use air if it is available, to clean out the interior thoroughly of scale, sand, fine particles of waste or any other foreign matter. A new brass applied without enough lateral, the ends riding on the fillet, causes trouble; for this reason, be sure a correct size is used. Solid brasses should always be sounded with a hammer to ascertain if the lining is tight. Poor tinning and throwing brasses around causes loose lining and other undesirable results.

Journal packing reclamation

Lubricating costs can be materially reduced by installing adequate facilities to renovate old journal packing. We must abandon the idea that most any old plant is good enough to reclaim dope, and the railroads that have seen this mistake and installed more modern plants, have already noticed an improvement in their cost, including a reduction in the number of hot boxes on all equipment.

During the past eight months I have had the opportunity to see old inadequate plants replaced with the more up-to-date ones, and it is remarkable the transformation that has taken place, not only in making the workmen happy and contented, but in the increased efficiency. In some cases forces have been reduced 50 per cent, to say nothing of the improved condition of the renovated packing. Packing plants should be light and well ventilated, vats and machines installed and arranged so that no extra steps are necessary. A packing plant can be put up at a nominal cost, semi-fireproof, built out of condemned car bodies, size 18 ft. by 40 ft., which, I believe, is large enough to take care of the average repair point.

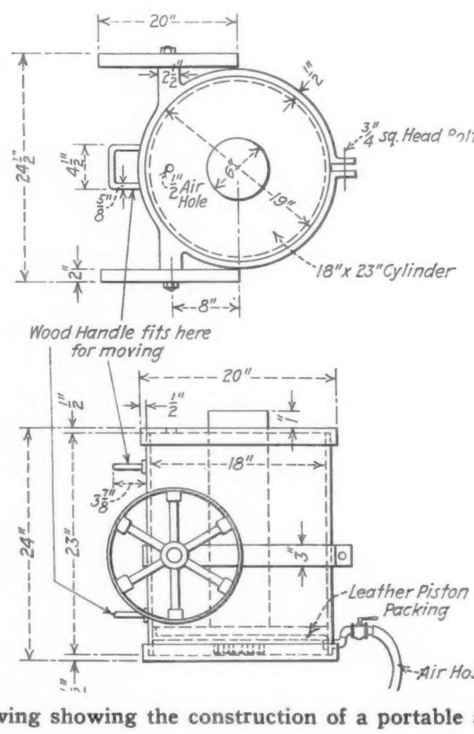
Centrifugal wringers and mechanical tumblers should be a part of the equipment in every reclamation plant, and will improve the grade of packing 100 per cent. Hand picked packing has never been a success. I find the most convenient plant is the one that is constructed so that only the attendant is allowed plenty of room to work.

The old packing is received through a chute into a warming vat. After being thoroughly warmed, it is placed in a mechanical tumbler and turned for five minutes at speed of 18 r.p.m. Then it is removed and placed in a washing vat, and swished back and forward with a pitchfork, then placed on a drain board until it has thoroughly drained. After this it is returned to a vat containing new or filtered oil, again placed on a drain board and kept there until it contains about 3½ pints of oil per pound of waste. Storage vats with drain valves at the bottom are used, and as fast as the oil drains off the packing, it is drawn from the vat and poured back over the packing, maintaining a uniform mixture at all times.

Oil filters should be a part of the equipment in the packing plant, and the oil analyzed periodically to know that it is fit to be used. Very good filtered oil can be obtained from a filter made out of an old oil drum or something similar. Apply two pieces of front end netting 14 in. apart, the lower netting about the same distance from the bottom, placing new waste between them. The netting is compressed, but not tight enough so that the oil will not flow freely. Add a steam coil in the bottom to heat the oil to about 100 deg. F. Oil put through a filter of this kind will test out about two per cent suspended matter.

Portable air jack for car repair shops

A PORTABLE air operated jack for raising cars clear of the trucks is shown in the drawing. It consists essentially of a 18-in. cylinder made of ½-in. sheet metal. The piston rod is 6 in. in diameter. The jack is carried



Drawing showing the construction of a portable air jack

on two cast iron wheels attached to the cylinder by a band which can be slipped on and clamped in the most convenient position. Loops for inserting a wooden handle are riveted to the side of the cylinder.

A Correction

The article entitled "Causes and Prevention of Freight Car Derailments," which appeared on page 23 in the January issue of the *Railway Mechanical Engineer*, was signed by T. H. Symington and his business connection was given as president of The Symington Company, Baltimore, Md. This information was erroneous as T. H. Symington has not been connected with The Symington Company since the reorganization of the T. H. Symington Company in 1924.

Locomotive repair shop labor saving devices

Development of machine attachments, cutting tools and jigs encouraged at the Houston, Texas, shops of the Southern Pacific Lines

At Houston, Texas, is located the principal locomotive repair shop on the Southern Pacific Lines in Texas and Louisiana. They consist of two enginehouses and a 14-pit erecting shop. In order to reduce the machine time on various jobs; to easily handle irregular parts; to obtain the maximum production from the machine tools available and to reduce the maintenance costs of locomotives, many labor saving devices such as jigs, fixtures, cutting tools, or machine attachments are used in these shops.

The following article contains a description of a few of the devices which have exceptional merit.

Practical jigs

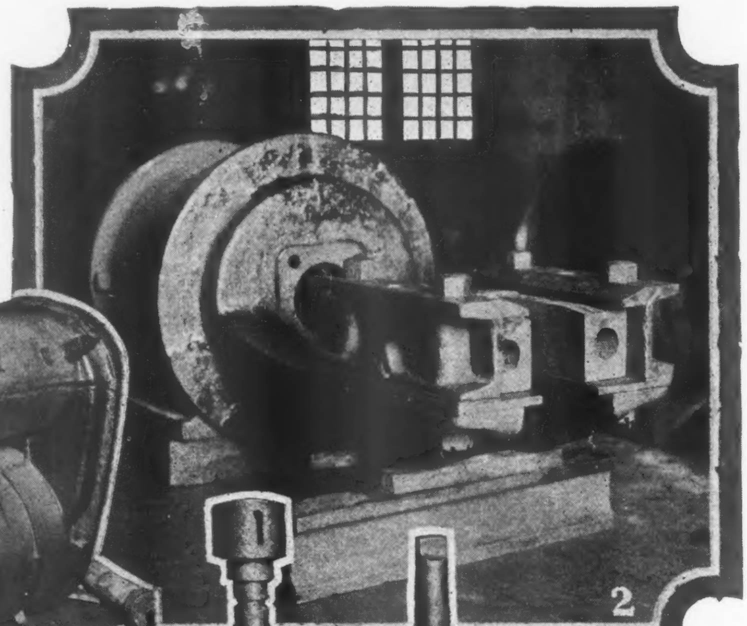
The usual practice, when drilling cylinder saddle holes, is to use an old man which requires considerable time to move about the saddle, to say nothing about the hard work involved. Considerable time is saved at the Houston shops by using the jig shown in Fig. 1. Its base consists of four heavy angle irons, two of which fit into the saddle frame fit. The two which pass across the front and back of the saddle are bolted to the ends of the others. An iron upright is bolted to the center of each of the transverse angle irons. A circular crossbar of heavy tubing passes through the ends of these uprights and on the bar is mounted a sliding pipe tee. This framework is held rigidly in place by four truss rods, two on each end of the cylinders. The center line of the circular crossbar is adjusted by means of the turnbuckles, to coincide with the center of the saddle radius. The feed screw of the air motor fits into the extension of the sliding tee, so that the operator may place the drill radially at any point on the saddle with one set-up.

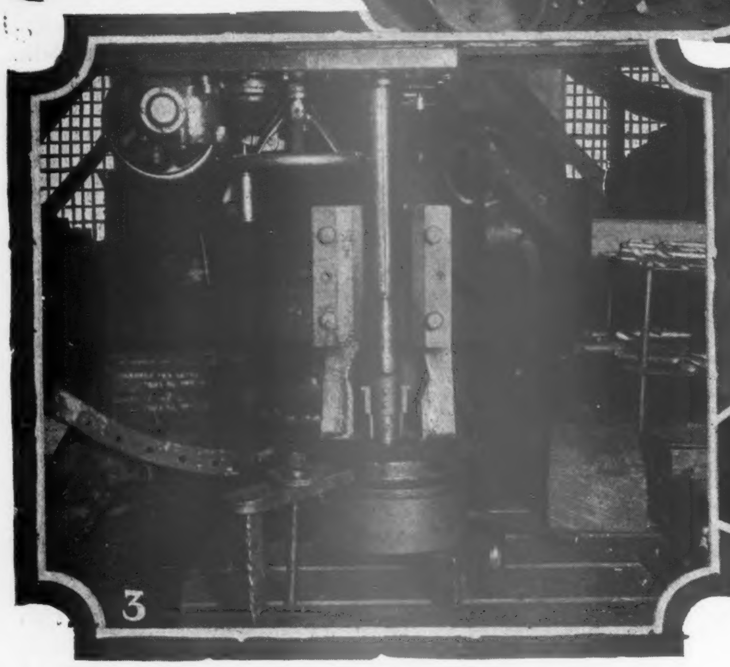
If valve crosshead guides are not properly lined up with the valve stem, undesired distortion will result. To overcome this trouble, the jig shown in Fig. 2, has been made for lining up these parts. It consists of a 14-in. air brake cylinder, the bottom head of which is bored out to the same size as the stuffing box on the back steam chest head. Through the hole in the stuffing box and the hole in the brake cylinder head, a mandrel is placed to which the standard valve crosshead is attached. The guides on the steam chest heads are then lined to the crosshead. This method insures correct alinement when the parts are placed on the locomotive.

Fig. 3 shows a jig used for boring out the back steam chest head stuffing box. The jig consists of a cast iron shell, the bottom of which is bushed to fit the boring bar. The top is bored out to take the cylinder fit on the back steam chest head. The jig is set on two parallel strips on the table of a radial drill press. The steam chest head is then placed in the jig and the whole is held on the table by two clamps. A 3-in. cutter is placed in the boring bar. The smaller diameter of the cutter makes the roughing cut while the larger diameter makes the finishing cut. At the same time it forms the joint for the gland and also acts as a stop for the depth of the cut. This is a simple and quick method of boring out an awkward casting.

By using properly designed jigs or fixtures, some of the work on the lay-off table can be eliminated and still secure accuracy in the finished work. A splendid example of such a fixture is shown in Fig. 4, the purpose of which is to drill, ream and fit the bolts in a Walschaert valve link and trunion blades at one set-up, the top blade being the only part laid off. The usual practice is to lay-off and drill each piece and then ream the holes to fit the bolts. As will be seen from the photograph, the three parts of the link are held in position by the trunions which are held in a three-part jig. The knee of the jig at the rear is bolted to the table of a radial drill press. The trunions are held in place by the

two caps which are drawn tight by four studs. Thus, the two trunions are lined up to a common center line. The ends of the trunion blades can now be quickly lined up for machining. This is done by placing parallel strips under each end of the link. The blades are lined up and held in place by two clamps, one at each end of the work. Parallel strips are placed between the blades and the link to prevent the springing of the trunion blades when the work is clamped. The four bolt holes can now be drilled, reamed and the bolts fitted at one set-up.





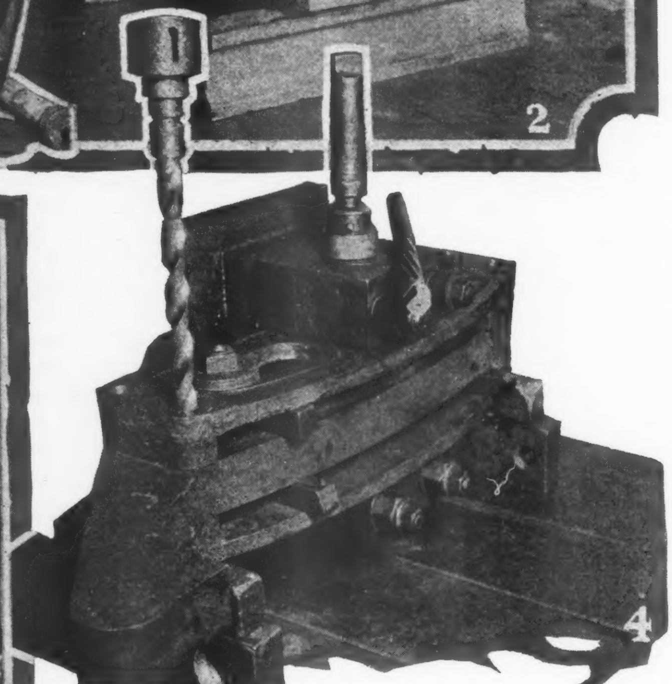


Fig. 1—A jig for drilling all the holes in a cylinder saddle at one set-up; Fig. 2—A jig for lining up the steam chest head guides to the valve crosshead; Fig. 3—A jig used for boring out the back valve chamber head stuffing box; Fig. 4—A jig which eliminates considerable lay-off table work when drilling, reaming and fitting the bolts in a Walschaert link

Machine attachments

Both time and power are lost on the return stroke of a planer. The planer attachment shown in the photographs and drawing, Figs. 5 and 6, utilizes this lost time and power. The tee portion of the device is machined from a solid piece of steel. The shank is 3 in. square and 12¾ in. long. The four cutting tools, two for the forward and two for the return stroke, are held in tool posts fitting into blocks which swing on ¼ in. per ft. standard taper pins. The surface of the blocks are knurled to prevent the tools from slipping. The tools are fed by hand. This attachment is used on crosshead shoes, 22 of which are shown set up in the planer in the photograph.

After a pair of wheels has been properly quartered on the quartering machine, it is good practice to true up the crank pins while the wheels are set up in the machine centers. Fig. 7 shows a turning tool on the end of the quartering machine boring bar. It is arranged so that two tools can be used if desired. The tool holder is placed on the bar with a taper fit to insure proper alinement.

Many shops are not equipped with a radius grinder for grinding the radii of Walschaert and Stevenson valve

gear links. However, most shops are provided with some type of internal grinder which can be used for grinding these parts if the proper machine attachment is provided. Figs. 8 and 9 show respectively a photograph and a drawing of such an attachment which is used at the Houston

Fig. 5—The upper view shows, at the left, the arrangement of four tools for cutting in the return stroke of the planer—The lower view shows 22 crosshead shoes set up on the planer

shops on a Madison cylinder grinder. The frame work consists of four vertical columns, the ends of which support a steel plate in the center of which is a bushed

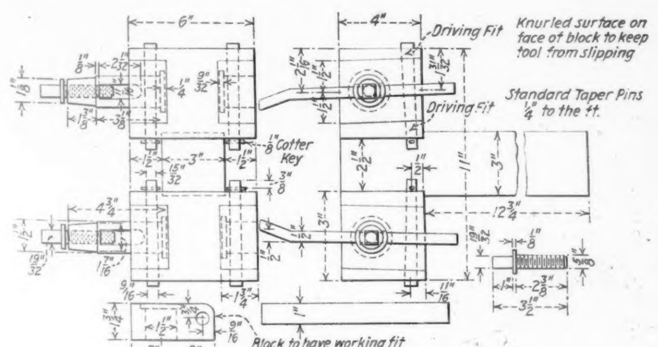


Fig. 6—Detail arrangement of tool used for cutting on the return stroke of the planer

hole. Through this bushing passes a vertical column which is in the plane of the spindle center. A horizontal arm slides on this column to which it is clamped by two set screws. The end of the arm carries a pendulum, slotted for adjustment in length to correspond to the radius of the link. As the sides of the link are square, it is a simple matter to line up the link to the desired grinding position on the face plate. The circular rod which extends down from the end of the pendulum cross

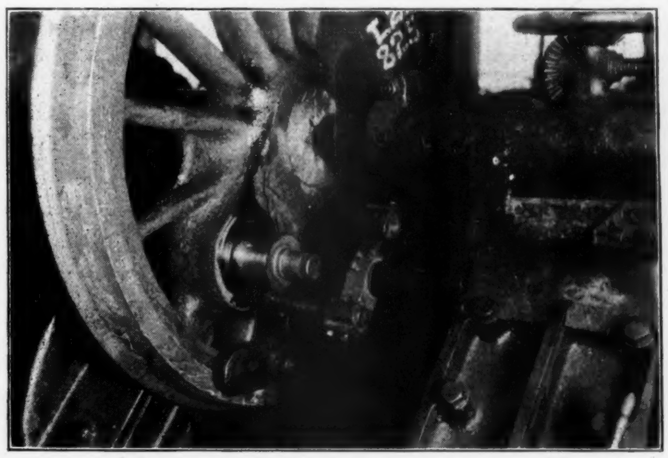


Fig. 7—Method of truing up a crank pin on a quartering machine

arm to the link is used for measuring the radius of the link while grinding. The rod is provided with a graduation so that it can be readily adjusted to the desired radius of each class of locomotive link. At the lower end of the pendulum is a face plate to which the link

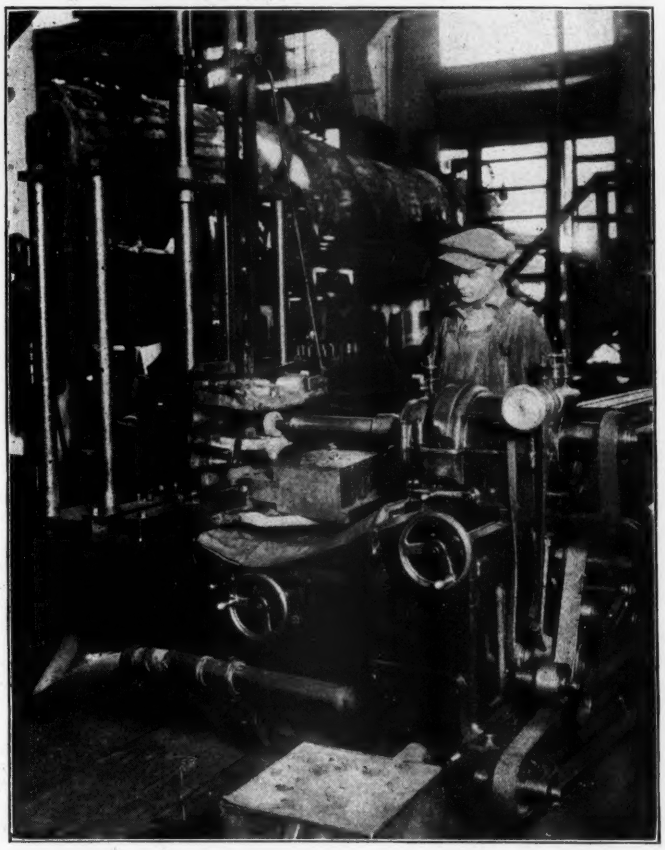


Fig. 8—Attachment used on an internal grinder for grinding the radius on a valve link

is clamped. Back of the face plate at the lower end of the pendulum is another heavy vertical plate, the lower end of which is fitted with a rack and mounted in a tee-slot of the grinder which permits it to move back and

forth transversely to the grinder spindle. A pin projecting from the back of the face plate fits in a vertical slot in the rack plate and the latter is traversed by the revers-

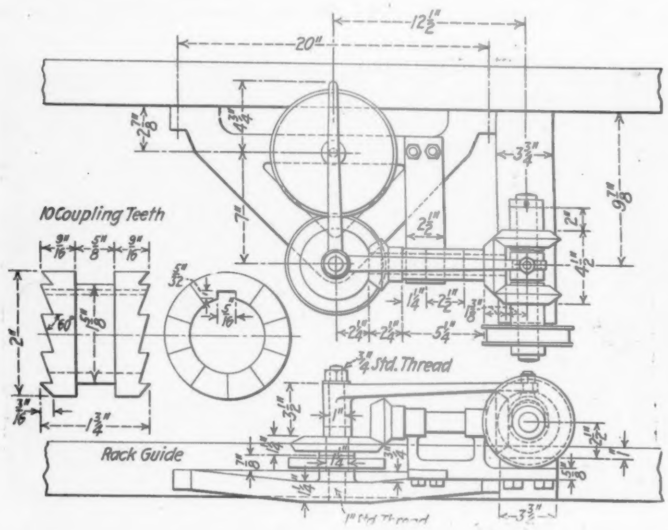


Fig. 9—Reversing mechanism of attachment for grinding the radii of valve links

ing mechanism shown in Fig. 10, the large gear meshing with the rack. The reverse lever is actuated by adjustable dogs on the rack plate. The device is belt driven.

an engine lathe with comparative ease. The reverse shaft is first placed on the lathe centers. The attachment, which consists of a train of three gears held together in a frame, is bolted to the lathe carriage. The tool holder consists of a circular gear ring which is slipped over the

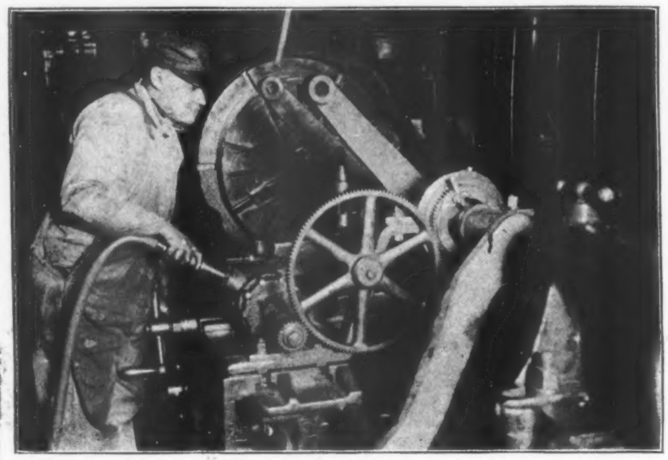


Fig. 10—Lathe attachment for turning a reverse shaft journal

end of the reverse shaft. It is then lined up in the two part housing in which it revolves. The hexagon spindle of the pinion gear is driven by a correspondingly shaped socket with a Morse taper shank, which fits into any

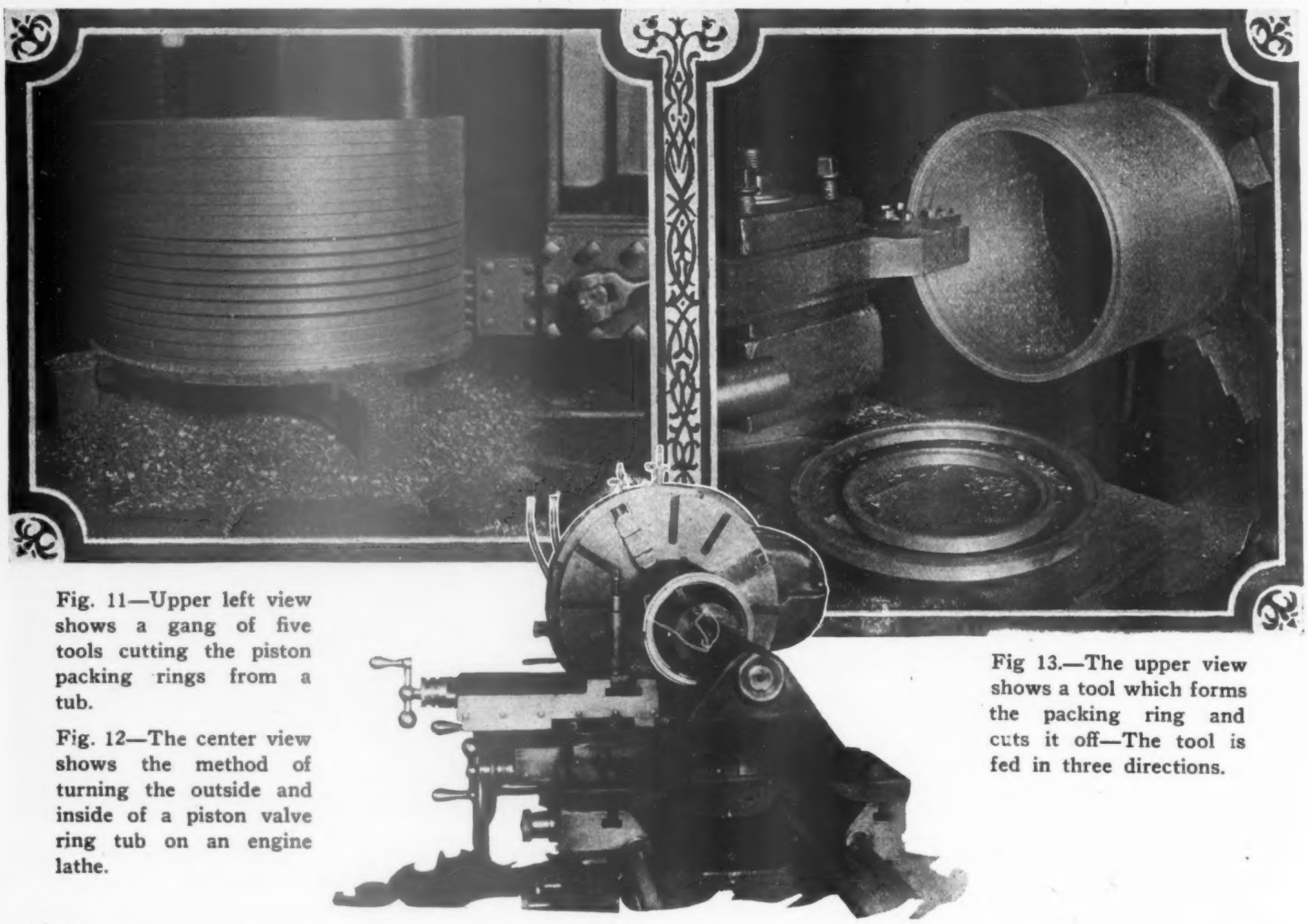


Fig. 11—Upper left view shows a gang of five tools cutting the piston packing rings from a tub.

Fig. 12—The center view shows the method of turning the outside and inside of a piston valve ring tub on an engine lathe.

Fig 13.—The upper view shows a tool which forms the packing ring and cuts it off—The tool is fed in three directions.

A reverse shaft is one of the most awkward locomotive parts to be set up on any machine. With the special attachment shown in Fig. 9, this part can be handled on

standard air motor. When making a cut the lathe is started, the center in the head stock revolving idly in the center of the reverse shaft. The tool is then driven

through the gear train by an air motor and is fed across the work by the lathe carriage.

Machine cutting tools

The machining on a side head boring mill of piston packing rings from a casting offers a splendid oppor-

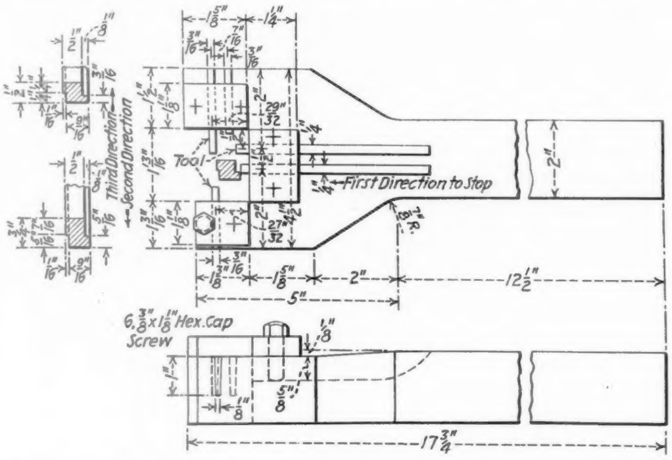


Fig. 14—Detail of lathe tool for forming piston valve packing rings

tunity to save time by boring the casting inside and out at one operation and by using a gang of tools for cutting the rings. The method of machining tub castings on a vertical boring mill at the Houston shops is shown in Fig. 11. The casting is finished turned on the outside and rough bored on the inside at the same time. Then a set of five tools is started to cutting off the rings. The rings are not entirely separated from the casting, however, as the tools cut through only as far as the stock that is left for the finish boring cut. The gang tool is withdrawn and the boring tool is started on the finish cut

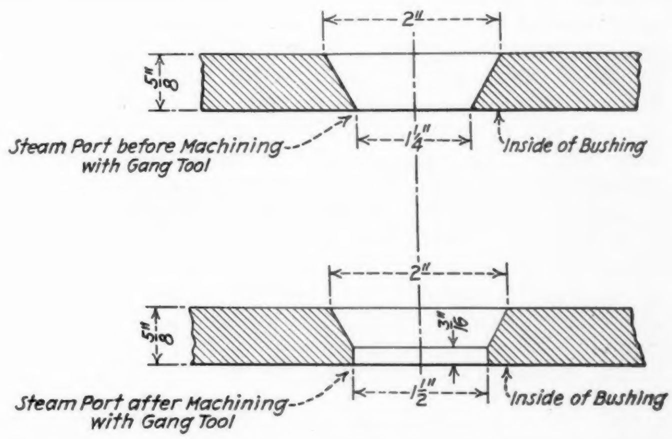
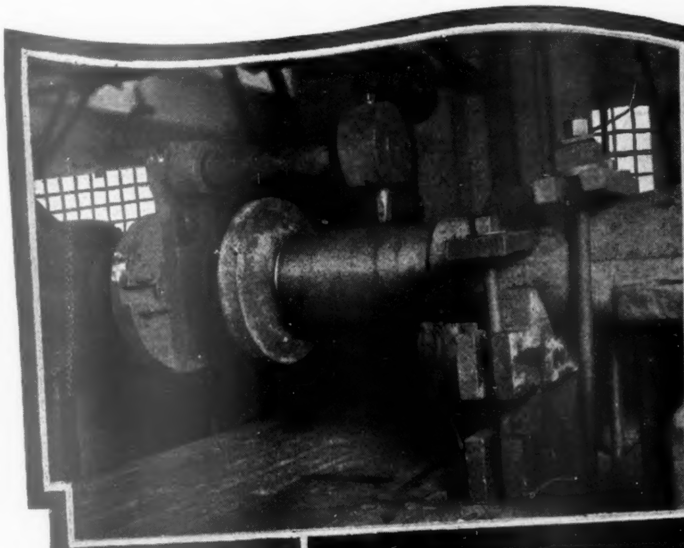
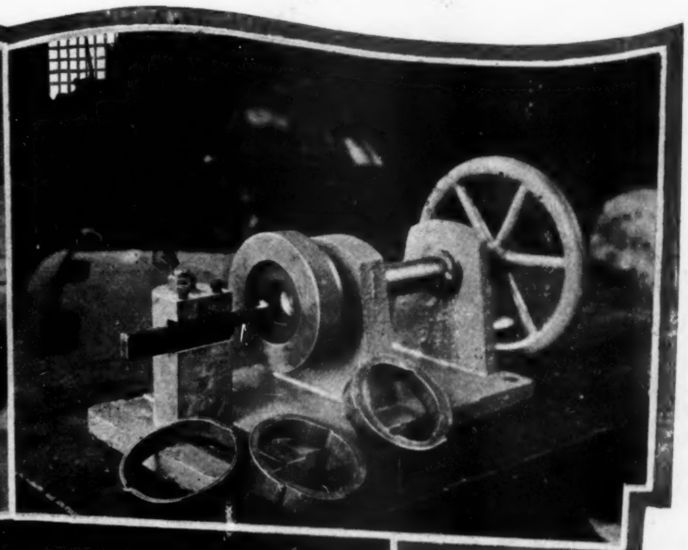


Fig. 18—The dimensions to which the port is machined on a boring mill with a gang tool

which separates the rings from the casting. This method not only saves time, but also eliminates the crumbling of the inside edge of the rings which occurs when the cutting-off tools are allowed to cut all the way through.





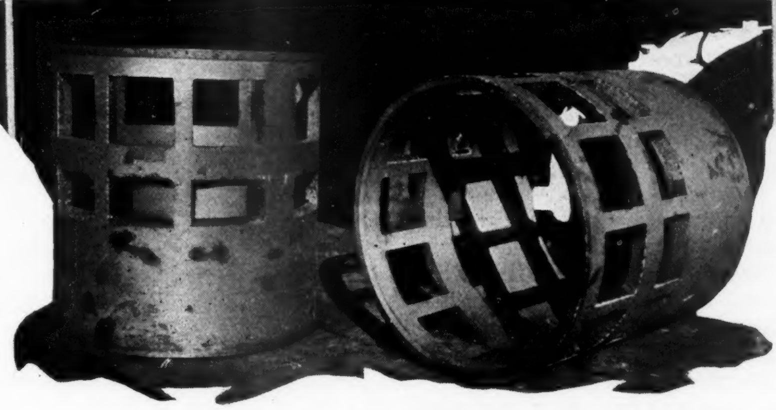


Fig. 15—The upper left view shows a method of machining a steam pipe fit on a horizontal boring, drilling and milling machine.

Fig. 16—The upper right view shows a hand operated portable machine for boring out piston rod packing

Fig. 17—The lower view shows two valve bushings the posts of which have been designed to eliminate milling and hand filing

Figs. 12 and 13 show the method and tool used for turning out piston valve rings by chucking the casting in a lathe. The casting tub is first finished inside and

out at one operation. The inside of the casting is bored out by a special tool which carries three cutters on its circumference. The shank of this tool is supported in a hardened steel bushing which takes care of the lathe spindle. After the casting is bored to size, the rings are shaped and cut-off by a special tool, a drawing of which is shown in Fig. 14. Three cutters and two stops are required in this tool to form the ring. The tool is fed successively in three different directions as indicated by the arrows on the drawing. No cut is taken in the first direction, which serves to bring it into position for the succeeding operations. This tool saves considerable time when using a lathe as the rings are completely finished in one set-up.

The machining of a steam pipe is another job which is difficult to handle owing to its irregular shape. Fig. 15 shows the machining of a steam pipe where it passes through the smoke box gland. The pipe is mounted on a horizontal boring mill. The tool is attached to the revolving head of the machine by a flange collar keyed to the spindle. The design of the tool allows it to clear

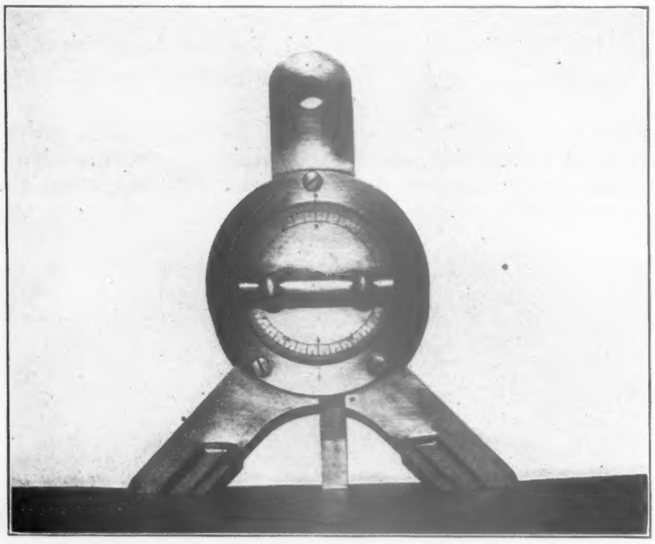


Fig. 19—Gage used for locating eccentric keyways on new axles for Stevenson valve gear

the flange of the steam pipe and it is fed across the work by the spindle feed.

Miscellaneous devices

The renewal of piston rod packing is one of the frequent jobs at an engine terminal. The packing has to be bored out to the size of the piston rod. As the packing is of soft metal it requires no great amount of power to do this work if the proper tool is available. Fig. 16 shows a hand operated machine for boring out Paxton Mitchell packing. To prevent the packing from turning while boring, the chuck is so designed that the outside of the largest size packing fits securely in a socket of the same shape. The knurled hand chuck is then screwed up against the face of the packing. The cutting tool is adjusted for the diameter to be cut after which the packing is fed to the tool by means of a hand wheel the spindle of which operates in two threaded bushings.

For the next smaller size of packing, the ring shown at the left in Fig. 16 is inserted in the chuck. This is merely a reducer. In like manner, the other two rings shown are used for smaller packing sizes. This machine is easy to make and operate and is readily portable.

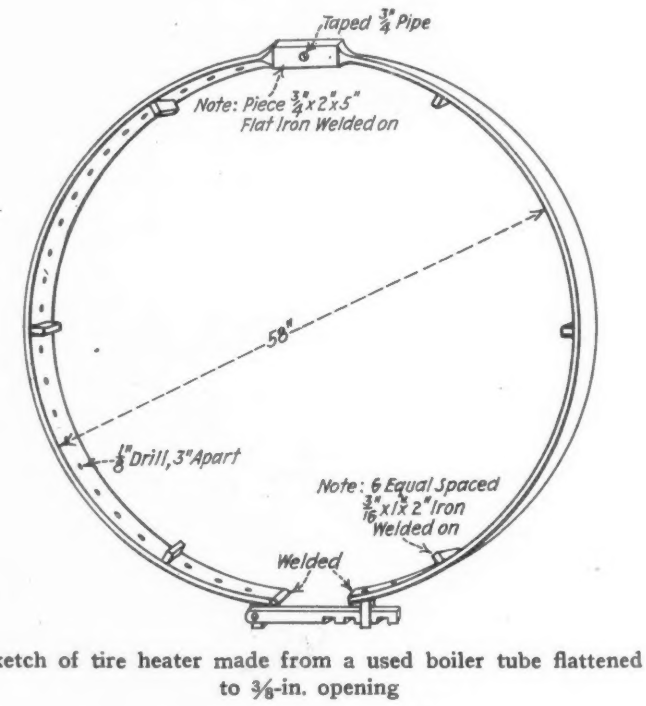
Fig. 17 shows a valve bushing, the ports of which have been designed to eliminate milling machine work and hand filing. This is accomplished by casting 30-deg. bevels on the outside of the circumferential sides of the port opening. The proper width and sharpness of the edge of the steam port is obtained by using a gang of tools, with the outside edges of the cutter ground to the width of the steamports, and cutting about 3/16 in. deep, as shown in Fig. 18, from the outside of the bushing. This work can be completed on a vertical boring mill.

The gage shown in Fig. 19 is used for locating eccentric keyways on new axles for locomotives equipped with the Stephenson valve gear. It is used in the following manner. The line is scribed on the axle through the wheel fit keyway and extends to the eccentric fit. The face plate of the lathe is quartered, which allows the axle to be revolved 90 deg. Another line is then scribed. A reference chart has been worked up which shows the relative position of the eccentrics with respect to the center line of motion for all classes of locomotives. The proper center line is selected from the chart and then the protractor is set so that the perpendicular scale coincides with this line. The spirit level is then adjusted to an exact level. The reading is then observed on the gage and the required number of degrees is added for the particular class of locomotive on which the work is being done, after which a line is scribed for the center line of the forward motion eccentric. The same method is followed for the back-up eccentric keyway.

Tire heater made from a boiler tube

By J. F. Bradley

A TIRE heater made from a used locomotive boiler tube is shown in the sketch. The tube has been flattened to a ⅜-in. opening in the center and has been drilled on the inside with ⅛-in. holes, three inches apart.

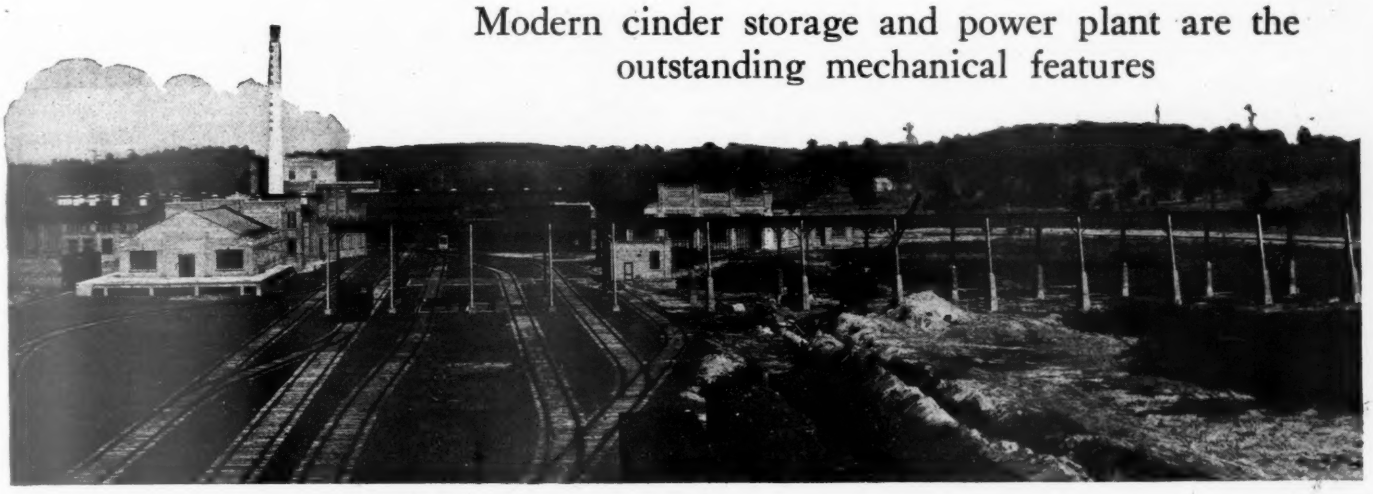


Sketch of tire heater made from a used boiler tube flattened to ⅜-in. opening

The ends are welded at the bottom and provision is made for adjustment to tires of different diameters. Fuel oil is forced through a ¾-in. pipe to the top of the heater as shown in the sketch.

Grand Trunk Western completes modern terminal

Modern cinder storage and power plant are the outstanding mechanical features

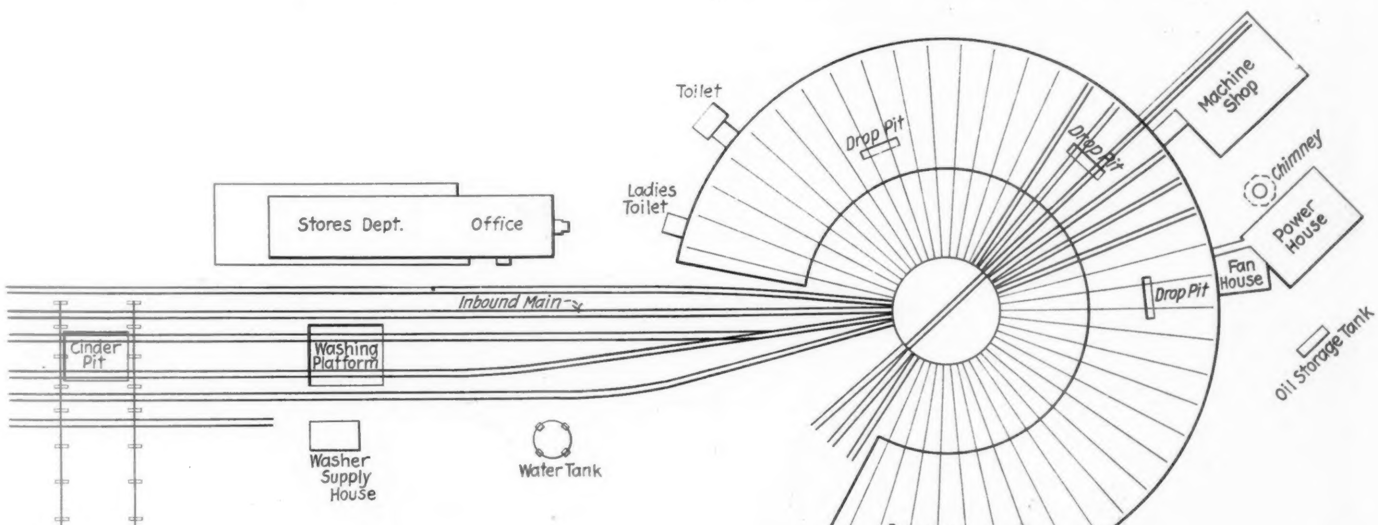


General view of new Grand Trunk Western engine terminal at Battle Creek, Mich.

THE Grand Trunk Western recently placed a new engine terminal in operation at Battle Creek, Mich., which is a notable example of a terminal designed for maximum operating convenience with a minimum of labor. The outstanding feature of lay-out—one which constitutes a radical departure from established practice—is the method of handling cinders. Realizing the great loss at times incurred by the necessity of holding cinders in cars until used by the maintenance-of-way department, an intensive study was made by the railroad company's engineers over a period of several years with the idea of eliminating this condition.

One of the illustrations clearly indicates the general arrangement of the ash pit and cinder storage facilities. The ash pit, a somewhat unusual variation of the water-type pit, is capable of handling an average of 100 locomotives in a 24-hour period without congestion. This is due, to some extent, to the fact that the ash pit capacity has been purposely limited so that it must be entirely utilized for fire cleaning rather than for storage. In other words, locomotives must be handled over the pits as fast as they arrive.

The design of the pit was worked out to provide maximum safety—it may readily be seen that the danger of men falling into the pit has been almost entirely eliminated. The cinders are removed from the pit with a clam-shell bucket and a traveling crane operating on a runway at right angles to the ash-pit tracks. The length of the runway is approximately 350 feet and the span of the crane, 60 feet. It has been found possible, under present operating conditions, to handle all of the 24-hour accumulation of cinders with this crane in about three hours.



Track layout of the Grand Trunk Western engine terminal

The estimated ground storage capacity of this cinder handling plant is a seven months' accumulation, based on the despatching of 100 locomotives each 24 hours.

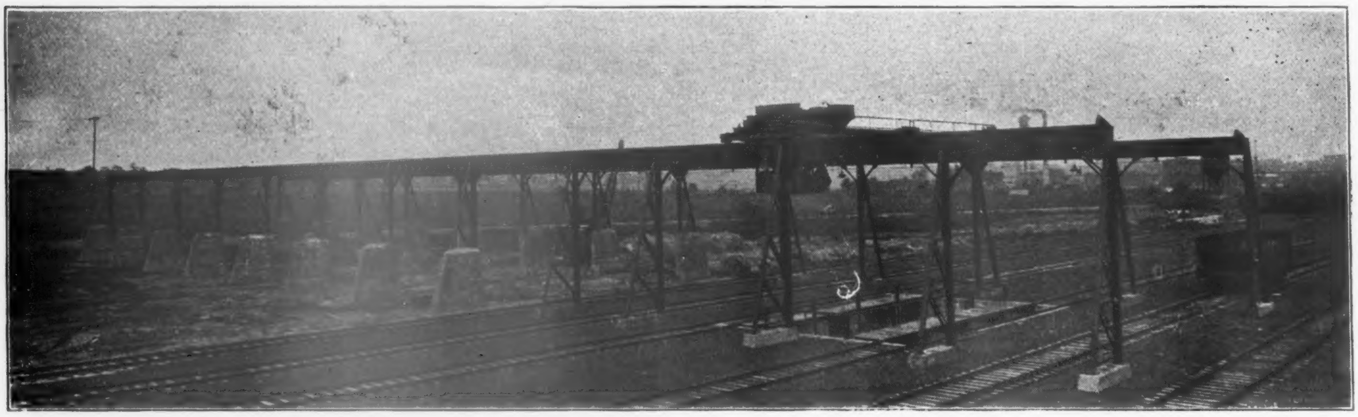
Another feature of particular interest from an operating standpoint is the track layout. One of the drawings shows that the tracks and switches have been arranged in such a manner that the blocking of the terminal is almost an impossibility.

Outside facilities

Approaching the terminal, locomotives first may be coaled at an automatic electric coaling station of 500 tons capacity provided with two coal chutes on each of three tracks. An average of 252 tons of coal is issued to locomotives each 24 hours while at times this approaches a maximum of 500 tons in the same period. Sand is also provided at the coaling station. The sand storage capacity is 350 tons. The hoppers and elevators for sand are the same as for coal handling. The coaling station is located about 1,500 feet from the turntable. One detail of the coaling station that is of interest from a mechanical standpoint is the installation of an independent electric-driven air compressor which eliminates the necessity of piping air over a distance of practically 2,000 feet from the terminal power plant.

Passing from the coal dock, locomotives may approach the turntable by means of five different tracks, two of which pass over the ash pit and engine washing platform, and converge onto a single track leading to the turntable. Each of the other three tracks provides access to the turntable. The locomotives are washed by means of the Durham & McGuirk engine washing system, using an emulsion of oil and water under steam pressure. Adjacent to the washing platform a well appointed wash house and locker room has been provided for the fire cleaners and engine washers.

Opposite this point is located the storehouse and office building, in the basement of which the oil and tool supply room is located. In addition to stores department offices the office building has space for the individual offices of the general enginehouse foreman, chief engine despatcher, and road foremen of engines, and an assembly and a first-aid room—all on the first floor. The second floor has locker rooms and shower baths for road crews. A unique feature of office arrangement has been carried out in the general enginehouse foreman's office. The location of his desk in a bay is such that he commands an unobstructed view of the entire terminal yard.

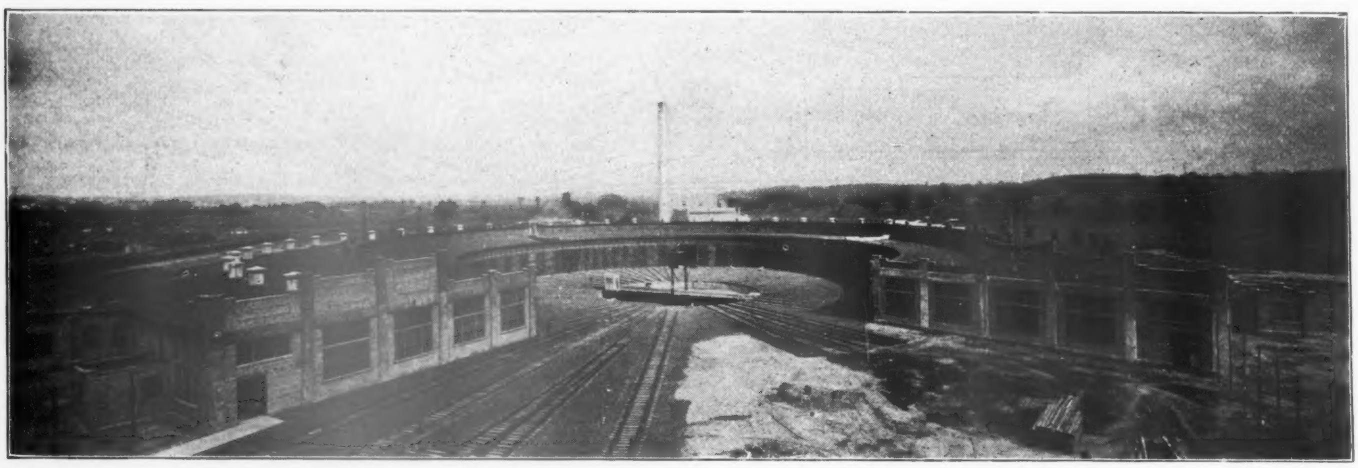


Cinders, which are stored until needed, are handled by this crane

The engine house

The engine house is a 40-stall timber frame and brick house built on a 52-stall circle and served by a 90-foot Bethlehem through-girder type, balanced turntable, electrically driven. The depth of the house is approximately 110 feet.

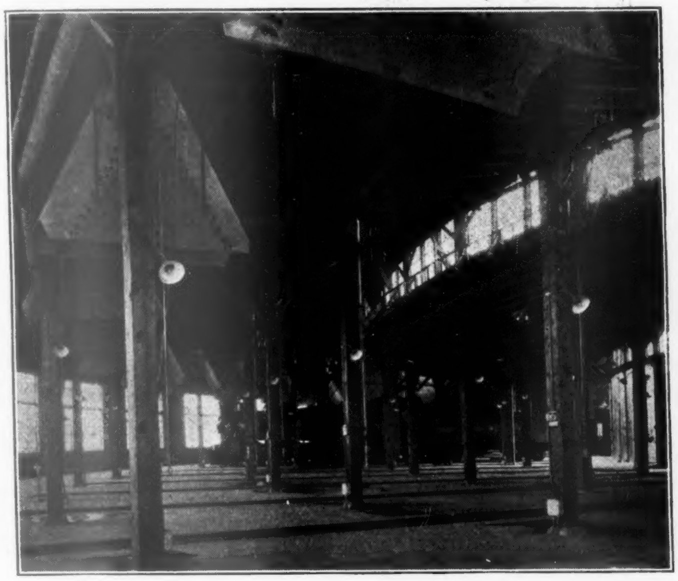
Stalls Nos. 8 and 9 are served by drop pit jacks to accommodate tender wheels; stalls Nos. 17 and 18 with jacks to handle trailer wheels; stalls Nos. 23 and 24 with jacks to handle driving wheels; and stalls Nos. 37 and 38 with jacks for dropping engine truck wheels. Watson-Stillman hydro-pneumatic jacks are used. No overhead crane facilities have been provided other than chain hoists at temporary locations for the handling of heavy materials. Practically all materials of this nature, either



The enginehouse is a 40-stall house. The power plant is visible in the background

in process of being transported about the shops and engine house or in process of repair work, are handled by means of a 3,000-lb. capacity Baker R. & L. portable electric crane.

All of the 40 stalls of the engine house are piped for the Miller boiler washing and filling system, while 15 of the stalls are, in addition, arranged for a direct steaming system designed by the Locomotive Terminal Improvement Company. All stalls are piped for steam blower lines and with oil for the oil firing system. Leadized pipe, furnished by the National Boiler Washing Company, Chicago, was used for hot and cold water lines throughout the enginehouse and powerplant.

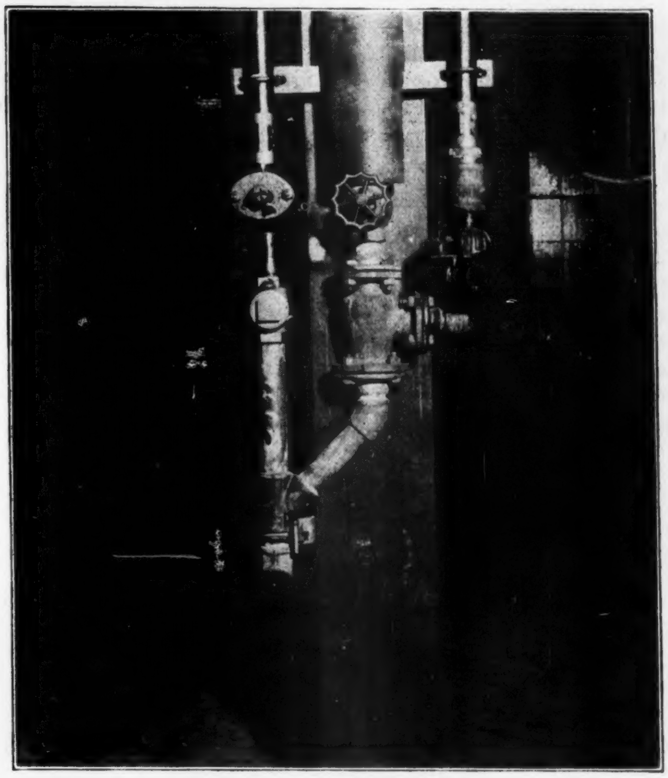


Interior view of the enginehouse

As previously mentioned, the engine house is completely equipped with an oil firing system. The fuel oil supply is stored in a 10,000-gal. tank, located outside, and filled by air pressure direct from tank cars. The oil is fed by gravity to a centrifugal pump which circulates it through the pipe lines to all stalls and returns it to the tank. A steam coil is provided in the main storage tank to aid the oil circulation in cold weather. At each stall there is an oil and air line drop together with 15 feet of special flexible oil hose equipped with a special firing nozzle, or torch. In the firing of locomotives, from four to six inches of green coal is spread on the grates, which is lighted by the oil torch through the fire door. Whereas in some engine houses, fires are started by spreading oil over the entire coal bed and igniting it, with this method an area on the grates of only about one or two square feet is first ignited with the firing torch and the house blower used to complete the firing process.

Offices for enginehouse and boiler foremen are located in the circle and are visible for a long distance

One of the illustrations shows the arrangement of the outlet piping at one of the stalls arranged with the combination of boiler washing, filling and direct steaming drops. By means of the direct steaming system, after the boilers have been washed out, they are filled with water at a temperature of about 180 deg. F. then, live steam is turned into the boiler at a pressure of approximately 150 lb. per sq. in.



One of the drops arranged for direct steaming or booster system

The machine shop

The machine shop is connected to the engine house opposite stalls Nos. 18 to 20 inclusive. The track at stall No. 18 is a through track, running from the turntable over the trailer drop pit and through into the machine shop. The tool layout is shown in one of the drawings. Following is a list of the machine tools in this shop, all of which were purchased new:

1 21 in. engine lathe
1 14-in. by 8-ft. American tool room lathe
1 No. 45 Buffalo punch and shear
1 Oster pipe machine
1 Bardons & Oliver 15-in. by 8-ft. brass lathe
1 1,500 lb. Nazel pneumatic hammer
5 5-hp. Ranson double end grinders (four of which are located in the engine house)
1 American 3-ft. radial drill
1 Tinners' folding machine
1 Stove pipe former
1 42-in. Bullard vertical turret lathe
1 Acme 3-in. single-head bolt cutter
1 50-ton hydraulic bushing press
1 Buffalo blower forge

Substantially constructed work benches equipped with swivel base vises are located at alternate stalls throughout the house. The photograph of the machine shop shows the monorail overhead traveler which serves all of the machines in the machine shop, as well as the through track from the engine house.

The power plant

Probably one of the most interesting things from a purely mechanical standpoint is the power plant, which is located opposite stalls Nos. 22 to 24 inclusive. In designing this plant every effort was made to install mechanical equipment of such nature as would permit its operation with a minimum number of men. As a matter of fact, the total power plant operating force at the present time, consists of three men, one on each eight-hour shift.

Steam is generated by two 250-hp. Connelly water tube boilers designed to operate at a working pressure of 150 lb. per sq. in.; Elesco super-heaters raise the temperature of the steam to a super-heat of approximately 100 deg. F. Natural draft only is used, this being provided by means of a concrete stack 150 ft. high and five feet in diameter at the top. The boilers are fired by Laclede

General view of the machine shop—An overhead monorail traveler serves all machines

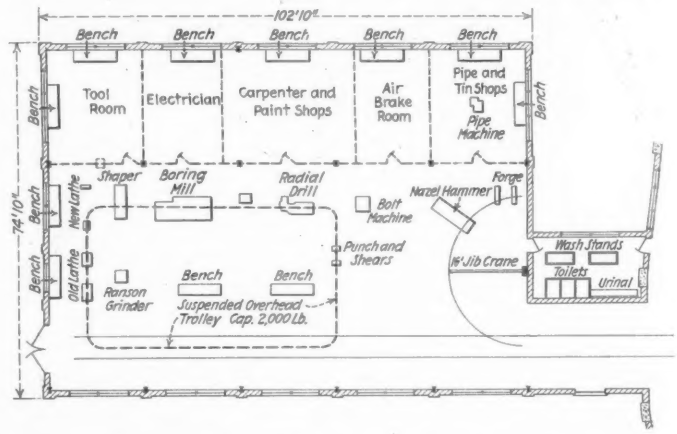
chain grate stokers and the coal and ash handling systems are of Brownhoist manufacture. The coal is dumped into a hopper outside the plant, run through a crusher into a conveyor and is elevated to steel overhead bunkers having a capacity of 150 tons. From the overhead bunkers the coal is conveyed by gravity to a traveling weigh lorry, which weighs each unit quantity of coal delivered to the boilers. The ashes are discharged at the rear ends of the stokers into a pit underneath the boilers. From this pit they are raked into the same conveyor which handles the coal and conveyed to an outside ash hopper having a storage capacity of approximately 50 tons. From this hopper they are dumped by gravity into cars.

The mechanical equipment of the plant consists of two air compressors, one of which is electrically driven, boiler feed pumps and wash out tanks and pumps for the boiler washing and filling system. A full complement of recording instruments has been installed.

During the construction of this terminal, considerable difficulty was encountered in overcoming the effects of natural-flowing wells and surface drainage water. One of these natural wells is located directly under the power plant. It was necessary to go to a great deal of trouble in the construction of the power plant foundations to seal the walls against seepage, and in addition a centrifugal pump has been installed. Fortunately, the purity of this water makes it of exceptional value for boiler feed purposes and it is planned to thus utilize it.

Heating and lighting

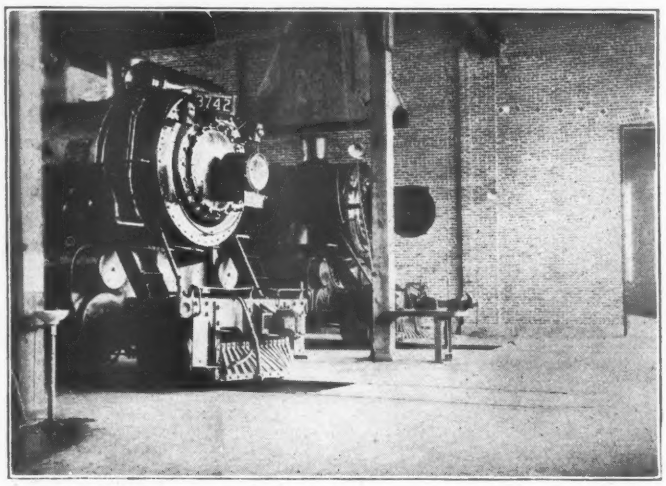
The engine house is heated by an indirect steam system. The air is heated by means of steam coils and circulated to each pit in the engine house by means of fans and con-



Arrangement of facilities in the machine shop

crete ducts. The total steam requirements of the heating system is approximately 400 b. hp. at an outside temperature of zero deg. F. Two 40-hp. fan engines driving Clarage fans furnish, under ordinary weather conditions, sufficient exhaust steam to supply the heating requirements of the engine house.

Each stall is artificially lighted by eight 75-watt lamps mounted on the columns with additional lamps located on the inside and outside circle walls. Switches are placed at



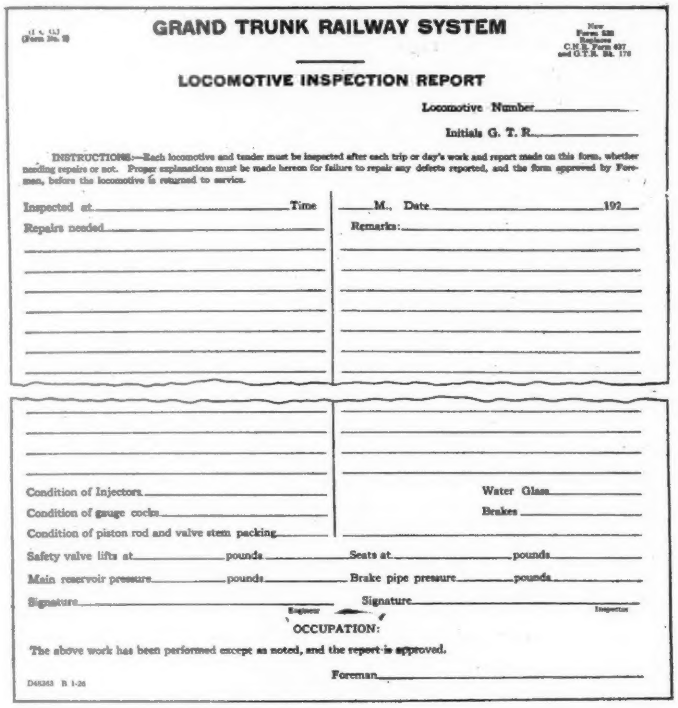
Work reports are posted at each stall and are removed only after all work has been completed

each end of each pit so that it is never necessary to walk more than half the length of a stall to turn lights on or off. Four receptacles are provided at each pit for portable extension lights.

Operating conditions

The new Battle Creek terminal, under present operating conditions despatches an average of 1,118 locomotives per month or 37 each 24 hours. About 93 per cent of the total power despatched is freight and switching

power. In general locomotives are assigned to regular crews. From this terminal power is despatched to Port Huron, Mich., on the east and to Chicago on the west. On the eastbound runs both freight and passenger locomotives operate over a district of 157 miles while on the westbound runs the freight locomotive district mileage is


(I. & O.)
(Form No. 9)

GRAND TRUNK RAILWAY SYSTEM

New Form 530 Replaces C.N.R. Form 437 and G.T.R. Bk. 176

LOCOMOTIVE INSPECTION REPORT

Locomotive Number______

Initials G. T. R.______

INSTRUCTIONS:—Each locomotive and tender must be inspected after each trip or day's work and report made on this form, whether needing repairs or not. Proper explanations must be made hereon for failure to repair any defects reported, and the form approved by Foremen, before the locomotive is returned to service.

Inspected at______Time______M., Date______192__

Repairs needed______ Remarks:______

Condition of Injectors______ Water Glass______

Condition of gauge cocks______ Brakes______

Condition of piston rod and valve stem packing______

Safety valve lifts at______pounds______Seats at______pounds______

Main reservoir pressure______pounds______Brake pipe pressure______pounds______

Signature______ Engineer Signature______ Inspector

OCCUPATION:

The above work has been performed except as noted, and the report is approved.

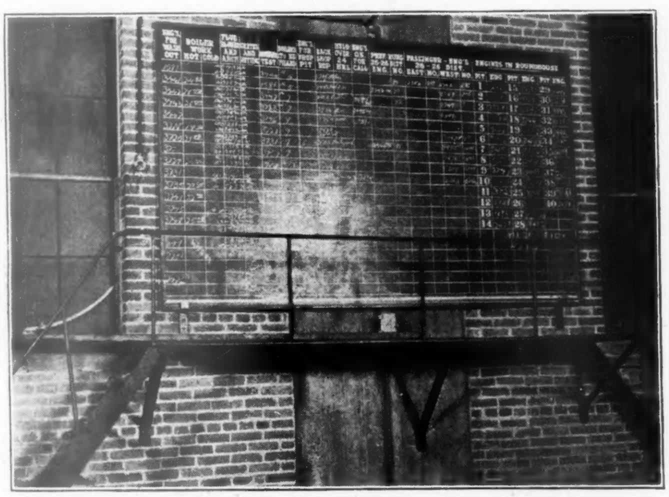
Foreman______

D48363 B 1-26

Locomotive inspection report which is posted alongside the locomotive in the enginehouse

169, and the passenger 185. The period of peak demands for power occurs between the hours of 11:00 p.m. and 6:00 a.m. which peak is occasioned by the arrival and departure of eastbound manifest freight trains from Chicago.

A system of handling work reports in the engine house



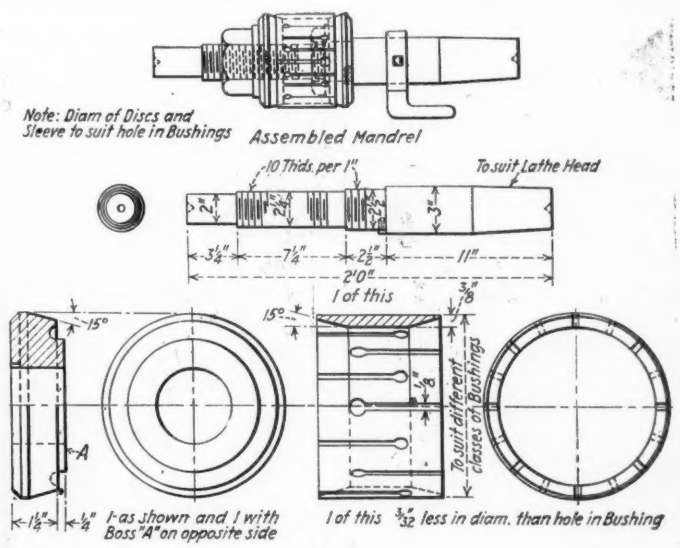
Board showing status of work and locomotives assigned

is in effect which seems to be a decided improvement over the methods employed at a great many terminals. The engineman's and inspector's work reports are combined on the right side of a single printed form. This completed work report form is posted in a metal frame at the stall in the engine house in which the locomotive is placed. As the individual items of repair work on that locomotive are completed the man having done the work enters his remarks and signature on the left side of the form. The foreman is thus able to ascertain at a glance the progress of the work on any particular locomotive. When he is satisfied that all work has been properly performed he attaches his own signature to the report and removes it to be filed away. The removal of the report indicates that the locomotive is ready for service. This scheme of handling reports saves a great amount of time. It is not necessary to go to the central work board to learn whether or not a locomotive is ready. The hostlers may check the assignment board and the presence or absence of the work report at the stall where the locomotive is located indicates whether or not it is ready to be taken out of the engine house.

Mandrel for turning rod bushings

By E. A. Miller

THERE are a number of railroad shops throughout the country that make it a practice to chuck rod bushings on a lathe for turning. This method requires reversing the bushing in order to finish the end which was held in the jaws of the chuck. The mandrel shown in the drawing, has been designed with the principal object of enabling the lathe hand to machine the bushing in one operation. Referring to the drawing, the mandrel consists essentially of a shaft turned and threaded as shown, an expander and two expander cones. The expander is placed inside the rod bushing. One of the

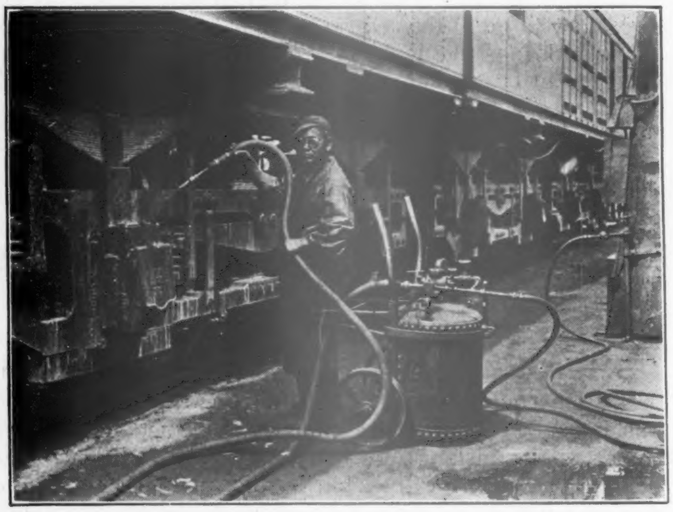


A convenient device for turning rod bushings on a lathe

expander cones is made to fit the 2½-in. seat on the shaft, where it is held in place by a 2½-in. half-nut and is prevented for turning by a key on the shaft. The shaft is then inserted through the expander, the second expander cone is placed on the shaft and the two expander cones are drawn together by means of a 2¼-in. nut. The expander is turned to 3/32-in. less diameter than the inside of the bushing and is slotted as shown in the drawing. As the expander cones are forced into the expander, the slots become wider, thus increasing the diameter of the expander. It only requires a few turns of the 2¼-in. nut to get a tight grip on the inside of the rod bushing and it is then ready to be placed in the lathe.

Frame washer for electric locomotives

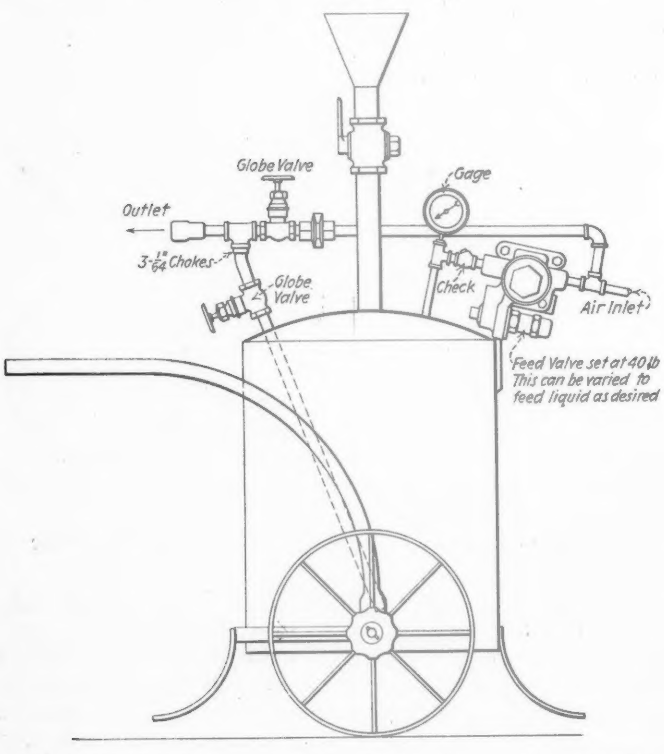
A SPECIAL type of frame washer designed for use on the frames of electric locomotives has been developed in the Chicago, Milwaukee & St. Paul shops at Deer Lodge, Mont. The washing machine usually used



The washer in service

with steam locomotives is not satisfactory for certain types of electric equipment on which the motors hang in such a position that water might enter and injure them.

The machine consists essentially of a drum fitted with



Side elevation of the washer, showing form of construction

pipe connections, a reducing valve, a gage, two globe valves, a filling cock and necessary hose connections, all mounted on a two-wheel truck. Air pressure forces the washing liquid upward through the pipe which extends to the bottom of the drum, through the globe valve and through a choke consisting of three 1/64-in. holes. It has been found that orifices of this size control the flow of the liquid sufficiently without other regulation. On a similar machine built previously, a feed valve was used, which is now done away with. The purpose of the feed valve was to carry various air pressures to further regulate the flow of the liquid but it has been found that with the three 1/64-in. holes, the pressure on top of the liquid provides about the right amount of spray.

The machine is operated as follows: The valve is closed on top of the tank and the valve on the air pipe is opened, allowing the shop air to flow through a convenient length of hose being used at the point marked "Outlet." The air passes through the outlet and through the hose and finally out of a nozzle which is made of a short piece of pipe flattened at one end, the nozzle has an opening which is 1¼-in. long by 3/64-in. wide. The air blast is first used to blow the dust from the frame after which the valve at the top of the tank is opened and the air pressure on top of the liquid causes the liquid to flow up to the tee just ahead of the air regulating valve where it becomes mixed with the air which is blown on the frame. This cuts the dirt sufficiently so that after one section of the frame has been treated with the solution the liquid is again shut off and the liquid and accumulated dirt blown free from the frame. With this arrangement no waste is used and the only other cleaning necessary is at points where free oil may have collected. The free oil is taken off with a little kerosene put on with a paint brush.

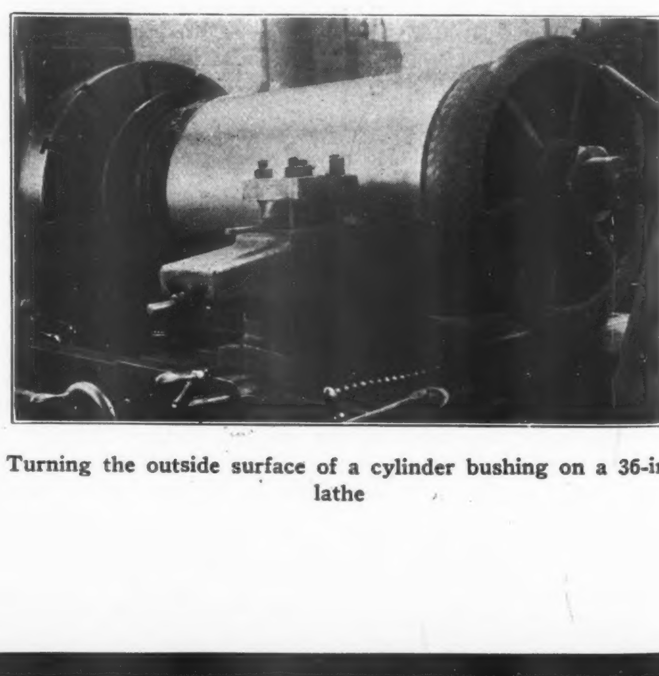
By this method, one man can clean both sides of the frame of an electric freight locomotive in two hours time. Before the washer was used it took five laborers the same length of time, the laborers using about 20 lb. of cotton waste and two gallons of kerosene for the job. The solution used in the washer consists of one pint of kerosene or mineral seal oil and 1 lb. of soap to each gallon of water. This mixture is boiled thoroughly before being put in the washer and the solution when made up costs about three cents a gallon.

A good way to machine cylinder bushings

By G. N. Cagle

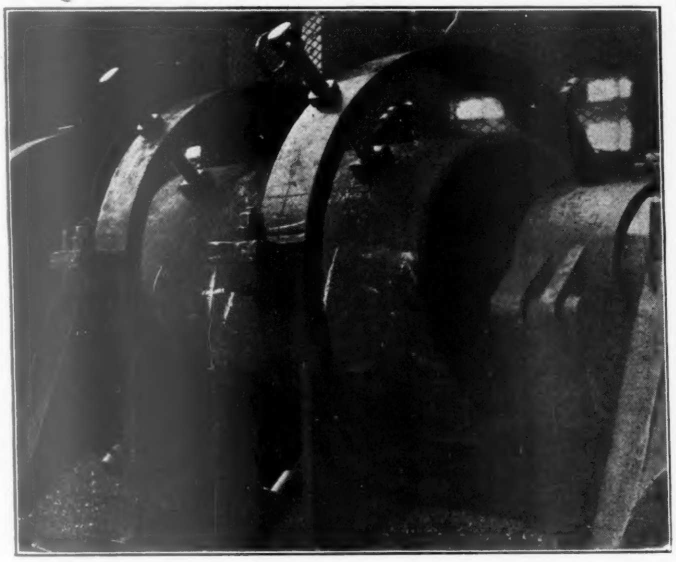
General machine shop foreman, Central of Georgia, Macon, Ga.

A SPECIAL jig for boring and facing cylinder bushings on a Newton horizontal boring machine has been developed in these shops. The bushing is first placed on a drill press and a hole is drilled in one end for a dog



Turning the outside surface of a cylinder bushing on a 36-in. lathe

to hold it while being bored and turned. The bushing is then placed in a special jig on the horizontal boring machine which is shown in one of the illustrations, for boring and facing. This jig consists of two cast iron sections for the base and two wrought iron top straps, provided with two screws for purposes of adjustment. A small steel block is attached to the ends of the adjusting screws to provide a bearing surface against the outside of the bushing. The time from floor to floor in setting up



Jig for holding a cylinder bushing on a horizontal boring machine while boring and facing

the bushing on the horizontal boring machine ready to bore when using this jig is ten minutes. At this set up, the bushing is bored, both ends counterbored and one end is faced off to leave the counterbore of the correct length. The time required for this operation is 7 hr. 15 min.

The bushing is next removed to a 36-in. lathe and is placed in a special jig for turning the outside surface. This jig consists of a shaft and two cast iron heads which are turned as shown in the drawing, to suit different size bushings. This jig as well as the one used for boring, is of rigid design and will stand heavy cuts and feeds. mill. Our experience has shown that doing this work on an engine lathe with blocks and bar or using an engine lathe with spider heads and adjusting screws will result in an imperfect job.

Jig for truing the cutting tools in a valve bushing boring head

MANY railroads are standardizing the methods of repairing valve motion parts. For example, piston valve bushings are bored out in steps of ⅛-in. instead of just truing up the worn bushing. Thus, if a 12-in. bushing is worn it is bored to 12⅛-in. This work is simplified further by keeping in the tool room boring heads with the tools set to bore the required diameter. Thus, if a bushing is to be bored to 12⅛-in., a pair of No. 1 cutter heads are asked for. Two heads are required as the two parts of the bushing are bored at the same time.

As shown in the illustration, these cutting heads are

Valve bushing boring head stand with a jig on top for setting the boring tools used in the heads

held on a stand, at the top of which is located a jig for properly adjusting the cutter tools to the correct diameter. The cutter head fits snugly over a pivot pin located in the center of the jig. The three hardened steel plugs used for setting the cutting tools are numbered consecutively 1, 2 and 3 and are held in position by a knurled nut. These setting plugs are lined up by a small keyway. This is

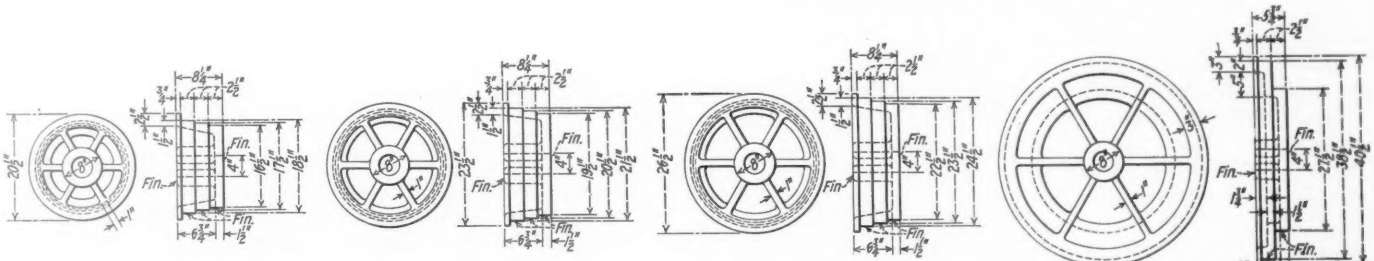


Fig. 1 Fig. 2 Fig. 3 Fig. 4

Drawing showing four sizes of mandrels used for turning cylinder bushings on the outside

Referring to the drawing, the jigs or mandrels used in turning the bushings are made of cast iron. The sizes range from 20½ in. outside diameter as shown in Fig. 1, which is the smallest, to 40½ in. as shown in Fig. 4. Figs. 2 and 3 are 23½ in. and 26½ in. outside diameter, respectively. The time required for this operation from floor to floor is 5½ hours.

We have found this rigging to be a valuable addition to our shop equipment because it performs the work much faster and also gives a more perfect cylinder when compared to the old method of finishing on a vertical boring

important as the ends of the plugs are ground while in the jig to give the correct diameter to be bored by the head. A set of three hardened setting plugs is required for each diameter of bushing to be bored.

This jig is simple to use but extremely accurate. A boring head is placed over the jig pivot. A set of plugs, to give the required diameter are placed in the three jig posts. The cutting tools are moved out to touch the setting plugs. They are then locked in place. Thus, the mechanic assigned to rebore a bushing has nothing to do with the tool setting.

The Reader's Page

Have You a Question? Ask it
Have You an Opinion? Express it

Further comment on freight car derailments

BALTIMORE, MD.

TO THE EDITOR:

In my article published in the *Railway Mechanical Engineer* for January the rolling mass of the loaded car was stated as the principal factor in derailments. While this is true of the high gravity coal car, it should be said that it is not the principal cause for derailments of rigid, all-steel box cars.

The open top coal car is sufficiently flexible to permit the car to stand on a track excessively out of surface, without unloading the wheels on any corner of the car, when there is no side-bearing clearance. The modern all-steel box car is, however, so stiff that we can only prevent the load from being removed from the wheels on one corner of the car by spring action in the truck itself.

We are only interested, of course, in what might be termed the "weave" of the track in a length equivalent to the track centers of a box car and the extent of this weave can be considered as the amount that the elevation of the rail between the two wheels on one corner of the cars is out of the plane of three similar points on the rails.

We frequently find conditions where the weave of the track is as much as 1½ in. or 1⅝ in. and it would certainly seem desirable to have our stiff box cars go over a track with as much as 2½ in. weave without taking the load off the wheels on any one corner of the car. This will, of course, necessitate long travel springs. It is obvious that soft, long travel truck springs will lend themselves more readily to car roll than short travel, stiff springs. So it becomes important with the long travel spring, to have absorptive action to prevent rolling.

It is well understood that there are two causes of truck spring failures; one from springs going solid under car roll, which puts an excessive fibre stress in the spring at some point in the coil; the other from fatigue, which comes from a large number of workings through a large range of stress. Work absorption will largely prevent both types of failure because, by reducing the car roll, the range of stress causing fatigue failure will be largely reduced, and when their working range is reduced by elimination of car roll they will not go solid and break.

It would seem, therefore, that the spring travel on an open top coal car is of no particular importance, and all that is desired is to absorb work and prevent the car roll. On rigid box cars a long spring travel is imperative, with the obvious necessity for absorption to stop the resulting increased tendency to roll.

Car designers have considered the desirability of cross equalization of the load from one side of the truck to the other. This problem is difficult and expensive because with a rigid box car it is just as essential to have cross equalization with the light car as with the loaded car, and there must be provision for satisfactorily normalizing the car body, both when running light and fully loaded.

T. H. SYMINGTON.

Ode to a roundhouse foreman

MINDEN, LA.

TO THE EDITOR:

The roundhouse foreman sat in his office chair,
It was seven a.m., and the weather fair,
He had plenty of power and engine crews,
So he called the porter to shine his shoes.
He had a soft snap, no doubt of that;
Nothing to do but sit where he sat,
And smoke his pipe and read the news.
All kinds of engines and engine crews!

At seven-fifteen, the telephone rang
A rasping voice at t'other end sang,
"Want an extra north for eight o'clock,
Another one south on Fifteen's block,
An extra switcher for straight up Nine,
The hogs got sixteen on the main line,
Give us a 'Mike' and an extra crew
To pull 'em to clear for Number Two.

"An engine crew on One at one-forty-eight
To protect Seventeen, running five hours late."
Then he gets a call on the company 'phone,
"Here's a message, signed, 'Engineer Stone':
'One-Seven-One's sheared a cross-head key.
Have another engine for Number Three.
Cylinder head's busted and bent one guide,
Lost thirty minutes, puttin' 'er on one side!"

Says to the clerk. "It seems to me
That the 'Old Man's car's on Number Three."
Does a little thinkin', scratchin' his mug.
Says, "Bill, get a fire in 'Ole Spark Plug.'"
Some Government inspectors, lookin' her around,
Says, "She'll have to have her boiler checks ground."
It don't make him sore to hear the "Op" relate,
"Number Three reported fifty minutes late."

His engine inspector, "Salt Eatin' Jim,"
Opens the door and reports to him;
"Boss, Four-Two-Five is on the 'gyp,'
They've tied 'er up with a little pink slip.
I think them fellers are full of bugs,
Say we missed some o' the wash-out plugs!
I been puttin' water in the Five-O-Two,
An' she shows up with a busted flue!"

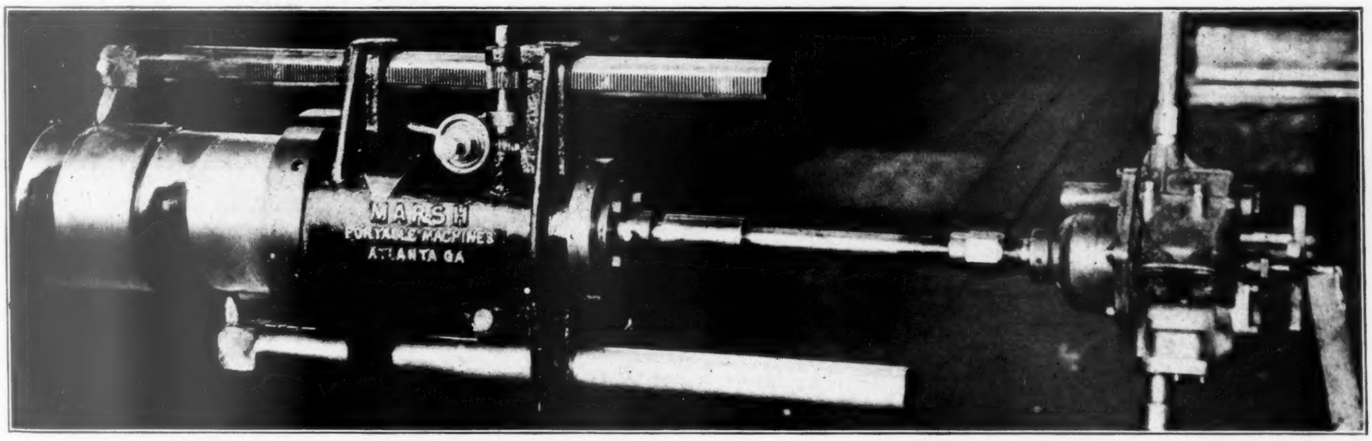
"It's time to go to dinner," the foreman said;
"I'll have to walk, 'cause my car is dead.
Bill, take a call on the Five-O-Two,
For three-forty-five and put in that flue."
And having nothing in the world to do,
Called the porter to shine the other shoe,
Sitting again in his office chair,
At peace with the world and without a care.

J. B. SEARLES.

Portable crank pin turning machine

On page 369 in the June, 1924, issue of the *Railway Mechanical Engineer,* appeared a description of a portable crank pin turning machine designed and patented by C. E. Marsh, 436 Hemphill Avenue, Atlanta, Ga. Since the publication of this description, many changes have been made in its design which have improved its adaptability to the work for which it is intended.

The principal advantage of this machine is that it will turn two journals on a crank pin at the same time, or will turn the rough and finish cuts at the same time on a crank pin having one journal and in either case, save one-half the time used by machines that have only one tool bar.



A portable crank pin turning machine using two tool bars provided with automatic feeds

The machine has two tool bars, each of which has an independent feed and feed control. The feeds are automatic and constant, unlike the old star feed. The bars are provided with a rapid travel to place the tool bars to a cutting position and to withdraw them at the end of the cut. A hand feed is also provided on each tool bar to be used when working out corners and fillets on crank pins. The tool bars are operated in the same way as the carriage on an engine lathe. The ends of the bars are provided with a tool holder that will allow the cutting tools to be set at any angle or position that is necessary to turn any kind of a crank pin job without having to offset or use bent tools.

The tool bars, which are made of high carbon tool steel, are 2-in. in diameter by 34 in. long. They can be made to any length to suit the needs of the class of work to be machined. The feed motion for the bars is generated from a worm on the spindle which is enclosed and runs in grease. The tool bars are fed out to the work by a gear rack which also acts as a key to keep the tool bar in proper alinement with the work to be turned.

The spindle is made of cast iron, tapered and bored out at the large end which is threaded internally to screw on to the adapters. The small end of the spindle is threaded on the outside for two thrust collars which also provides a means of adjusting any wear in either the spindle or rotating cylinder. The small end is bored and bushed for the driving and intermediate shafts.

The rotating cylinder is tapered to fit the spindle and is counterbored in the small end for the internal gear that drives the cylinder. The cylinder has two arms on each side that are bored out for the tool bars, and it is also cast with lugs and pads to carry the feed shafts and feed mechanism. The driving and driven gears are enclosed within the spindle and rotating cylinder which protects the operator. All gears and feed shafts are made of alloy steel and are heat treated. The machine is driven by a spur gear meshing with two intermediate gears in the small end of the spindle, which drives the internal gear keyed to the rotating cylinder.

The machine is provided with two master adapters that will adapt it to any size of crank pin. They also aline the

machine accurately with the axis of the crank pin without the use of calipers or other measuring devices. The machine can be set up and a cut started within five minutes. One master adapter is provided for crank pins having outside valve motion which is bored out to fit over the largest size crank arm fit and bushed to fit the smaller sizes. The adapter is threaded on the outside to fit the crank pin machine. Another master adapter is provided for crank pins having threaded and counterbored ends.

The machine has a cutting range from 3½ in. to and including 11½ in. in diameter, and up to 20 in. in length with the standard length bars furnished with the machine. The machine, without the tool bars, weighs about 155 lb. and with the two bars, about 225 lb. It may be driven either by an electric or air motor. A burnishing attachment can also be furnished with the machine.

Double head bolt threader and nut tapper

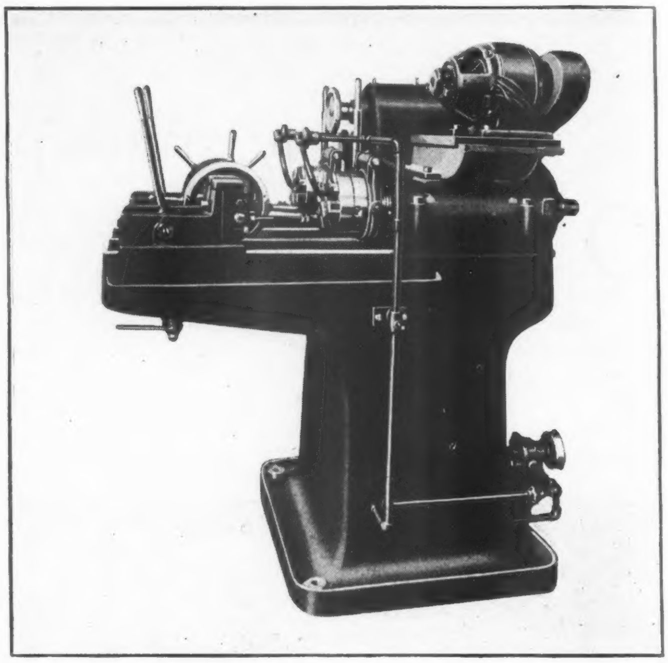
THE Landis Machine Company, Waynesboro, Pa., has placed on the market a new design of ½-in. double head threading machine which is used for cutting threads and tapping nuts either right or left-hand within a range from ¼ in. to 2 in.

It has a geared headstock and single pulley drive. The main spindle has bronze bearings, the purpose of which is to insure a long life under hard service conditions. This machine may be equipped with a lead screw attachment prior to its being placed in service. Only one lead screw is required for each carriage. The changes in pitches are taken care of by a substitution of gears.

The die head is opened and closed automatically at predetermined limits by the carriage, or by hand. The vise has a horizontal lateral, as well as a vertical centering adjustment, the purpose of which is to insure permanent alinement with the die. A full supply of cooling lubricant at the die head is maintained by a rotary pump. There is a special control valve at the die head for shutting off the oil supply when necessary. The frame is cast in one piece with a liquid tight bottom.

The driving pulley is mounted on top of the machine. The die head is driven by four speeds which give it 157, 226, 315 and 441 r.p.m. The machine is readily converted to motor drive, the power being transmitted from the motor shaft to the drive shaft by means of a belt. The motor is mounted on a plate located on top of the headstock to economize floor space and to prevent dirt and oil from accumulating on the motor parts.

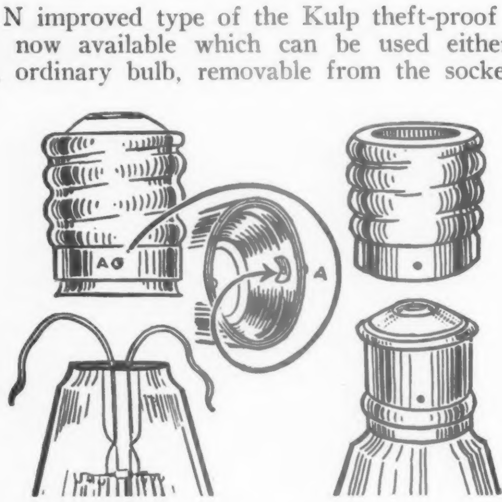
The floor space occupied is 4 ft. 1⅛ in. by 3 ft. 2⅜ in. The net weight of the belt-driven machine is 1,500 lb., while the net weight of the motor-driven machine is 1,750 lb.



Land's ½-in. double head, motor driven threading machine

Improved theft-proof lamps

AN improved type of the Kulp theft-proof lamp is now available which can be used either as an ordinary bulb, removable from the socket, or as a theft-proof lamp so that one stock of lamps can be used for both purposes.



Exploded view showing base and shell assembled, base and shell separate and shear pin which prevents the base from turning in the shell

The principle is simple. The threaded shell is held rigidly to the base by the small pin and washer (a). The lamp is inserted in the socket as usual until contact is made. If an extra twist is given, this pin is sheared off, allowing the lamp and base to turn freely in either direction while the shell remains in the socket. To remove, the bulb is broken, after which the shell may easily be reached and unscrewed. Since the lamp can only be removed by breaking, incentive to theft is removed.

The lamp itself is standard, carrying standard guarantees and sold at standard prices and discounts, exactly the same as for ordinary lamps. No changes in sockets are necessary and no extra attachments required. The patented theft-proof feature is part of the lamp base, built into the lamp at the factory.

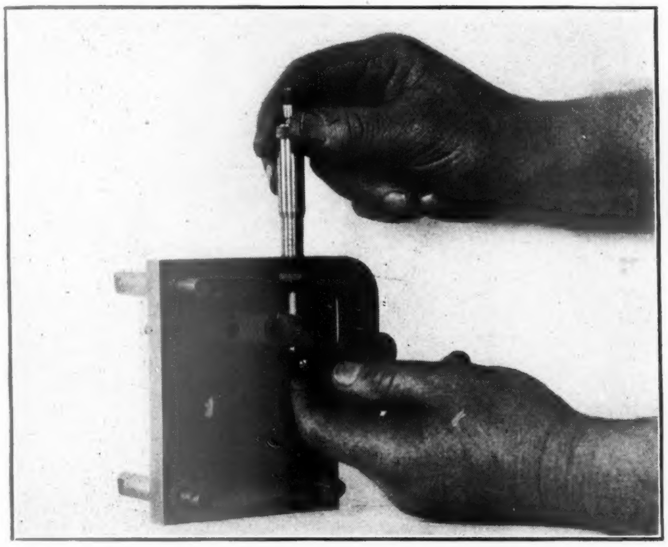
The possibilities of this lamp in railroad service are apparent for shops, stations, freight houses, office buildings, round houses and other exposed places. Figures submitted by some railroads show an annual loss from the theft of lamps varying anywhere from 15 to 30 percent

of their lamp purchases. One large system writes off $13,000 a year in this way. A smaller line admits to $3,000 loss in ten months. These are suggestive figures, rendered important since the entire amount can be saved.

These lamps are manufactured in all standard sizes and types by the Kulp Theft Proof Lamp Company, Chicago, and sold and serviced to railroads by the E. A. Lundy Company, Pittsburgh, Pa.

Taper parallel gages

A SET consisting of 10 parallel gages used for measuring small holes from 1/4 in. to 1 in. by .001 in. has been placed on the market by the Brown & Sharpe Manufacturing Company, Providence, R. I. The toolmaker will find these gages particularly useful in checking out-of-the-way holes, which are sometimes hard to measure on jig and fixture work. They can be used also in blind holes, slots, etc., in different positions, not only to determine the size of a hole, but also to find out whether or not the holes are out of round. They are made of high grade tool steel, hardened and ground to very close limits. Each strip is tapered and two strips placed together, form an adjustable parallel gage. The top, or measuring surfaces, are ground on a radius to insure a correct measurement.



Method of using the Brown & Sharpe tapered parallel gages

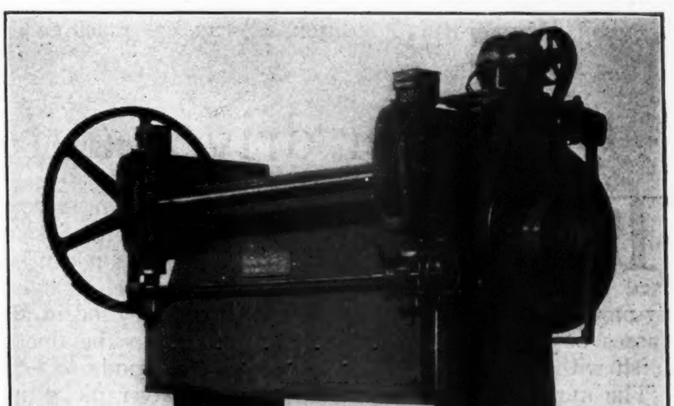
The accompanying illustration shows how they are used. The two strips, when adjusted to fit snugly into the hole, are measured across the two surfaces with a micrometer or a vernier caliper. In this manner the exact dimension is obtained in thousandths of an inch.

To facilitate the selection of the strips to be used in the hole to be measured, they are stencilled from *A* to *G*, inclusive. There is a plate attached to the inside of the lid of the box which holds the gages. On this plate are two parallel columns under the headings "size" and "use." If a hole is to be measured which has a diameter between 3/8 in. to 29/64 in., a glance at the plate will show that strips *B* and *C* are the ones to be used.

Cincinnati all-steel press brake

AN all-steel press brake used for bending, forming, flanging, or punching sheet metal for a variety of work used on freight and passenger cars, has been placed on the market by the Cincinnati Shaper Company, Cincinnati, Ohio. It is constructed of rolled steel plate in such a manner and with working stresses so low as to forestall trouble from carelessness, accident or defect. Furthermore, it eliminates the trouble from deflection in securing perfect bends and removes any limitations on the width of material handled by means of an open throat.

The two housings are cut from 3-in. solid steel plate and finished to 2¾ in. The ram and the bed of the machine are also cut from similar plate with heavy angles welded on for additional stiffness. The top of the bed is made from a steel billet machined in the shape of a saddle and solidly welded to the main plate. All gears, including the large one, are of steel and accurately cut. Double keys of the Kennedy type are used throughout. The screws are cut from high carbon, high nickel steel with a buttress thread to do away with the bursting effect on the connecting rods. A 5-in worm and wheel adjustment to the screw is operated either by hand or power. Quick bearings for the ram or hammer are gibbed in both directions and provide for the thrust encountered in punching. The clutch is of a multiple disc type, using special asbestos material on the friction surfaces. The flywheel is mounted on ball bearings, as is the idler pulley for the motor drive and the worm adjustment to the ram. All shaft bearings are bronze bushed. The worm and worm wheel adjustment and the power elevating device all run in oil, and all parts not protected in this manner are automatically oiled from the two oiling stations on top of the housings.



Cincinnati series 70 all steel press brake

The control of the machine is either by foot treadle or hand lever, both of which can be moved at the wish of

the operator at any position across the front of the machine. An efficient brake is provided for stopping the machine immediately upon release of the clutch.

The machine has a 3-in. stroke, 5-in. adjustment and a throat clearance from the center of the dies of 8 in.; it runs at 30 strokes a minute. It can be furnished in any length from 4 ft. 6 in. to 10 ft. 6 in. between housings and has a capacity for making right angle bends, continuously and at one stroke in 10-gage steel, 10 ft. long, over a 1⅛-in. die to a radius equal to the thickness of the metal. It is furnished for either belt drive or arranged for motor drive, with the motor mounted on top of the housings.

A heavy and light duty metal cutting saw

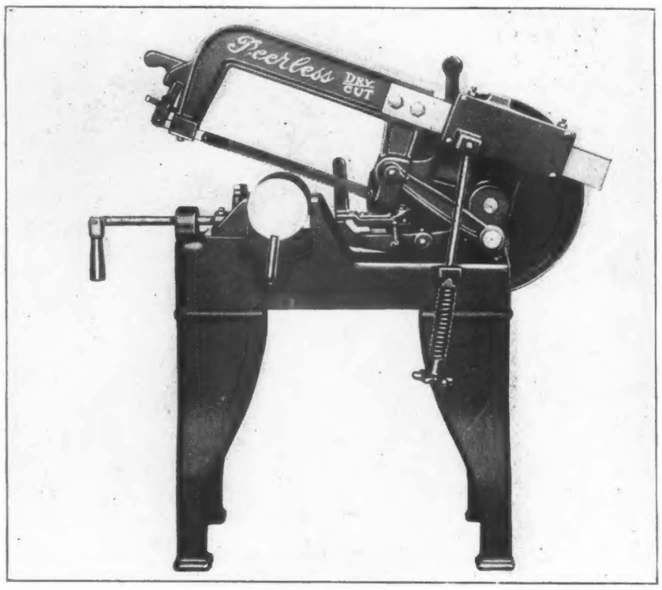
A NEW 9-in. by 9-in. size of the universal type of high speed metal sawing machine and an entirely new type of Dry Cut metal saw has been placed on the market by the Peerless Machine Company, Racine, Wis. The universal saw is built in two other sizes; namely, 6 in. by 6 in. and 13 in. by 13 in.

As in the case with the other two sizes, the intermediate capacity machine has the full square saw blade frame; quickly adjustable spring controlled feed pressure, with worm and ratchet type of feed; blade backing plate; swivel vise; three-speed gear box; lift on return stroke; automatic stop and lift of the saw frame to the starting position at the completion of a cut, and height and depth gages.

The machine has a capacity of 6 in. at a 45 deg. angle; takes a blade 14 in. to 17 in. long and has speeds of 125, 85 and 50 strokes per min. It requires a 1½-hp. motor designed to run at 1,700 r.p.m. to 1,800 and takes a floor space of 26 in. by 52 in.

The Dry Cut power saw has a capacity of 4½ in. by 4½ in. and is intended for general purpose work. The same principles of construction and operation have been incorporated in this machine to as great an extent as possible, as are embodied in the other Peerless metal cutting machines. These include the lift on the return stroke; quick adjustable feed pressure, spring controlled; automatic stop at the completion of a cut, and the advantage of the saw frame remaining in any position it is placed while setting stock. The machine runs at a comparatively low speed as it cuts without a lubricant. It is possible, under this condition, to run the machine at 100 strokes per minute when cutting low carbon steel.

A 10-in. blade is used in the machine, which makes



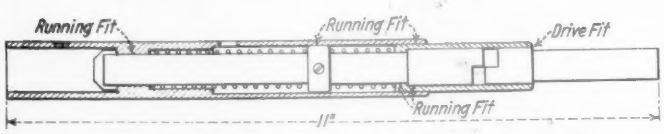
The Peerless 4½-in. by 4½-in. Dry Cut saw for general purpose work

a stroke of 4½ in. A ¼-hp. motor designed to run at 1,750 r.p.m. drives a 2¼-in. by 14½-in. pulley. It requires a floor space of 16 in. by 30 in.

Power driven automatic screw driver

THE illustration shows a power-driven screw driver, so designed by Stansell Automatic Screw Driver Company, Seattle, Wash., so that it can be used in all kinds of wood-drilling machines, electric or air-motors and also on drill presses. It can be used in all classes of woodwork from the plain rough to the finest finish without damage to the surface of the wood.

The motor will run continually as the driver picks up



A screw driver which automatically stops when the screw has been driven to the proper depth

the screws and releases them automatically at any set depth. The motor switch is turned on, the driver placed over the screw and pushed down.

The bit has a round shank where an adjustable drill-chuck is used on the motor, or is furnished with a number one taper shank when specified. The bit is made of special steel and fits into a dovetailed slot. It also holds the driver together. Tests made show that the bit will stand driving 2½-in. screws into hardwood blocks without lead holes.

By the tension of the springs, the bit is forced to the bottom of the screw slot; at that time the clutch ends come together and hold until the screw is driven home. The device has a depth collar that can be easily adjusted to drive screws to a depth of ¾-in.; the collar also holds the springs in position.

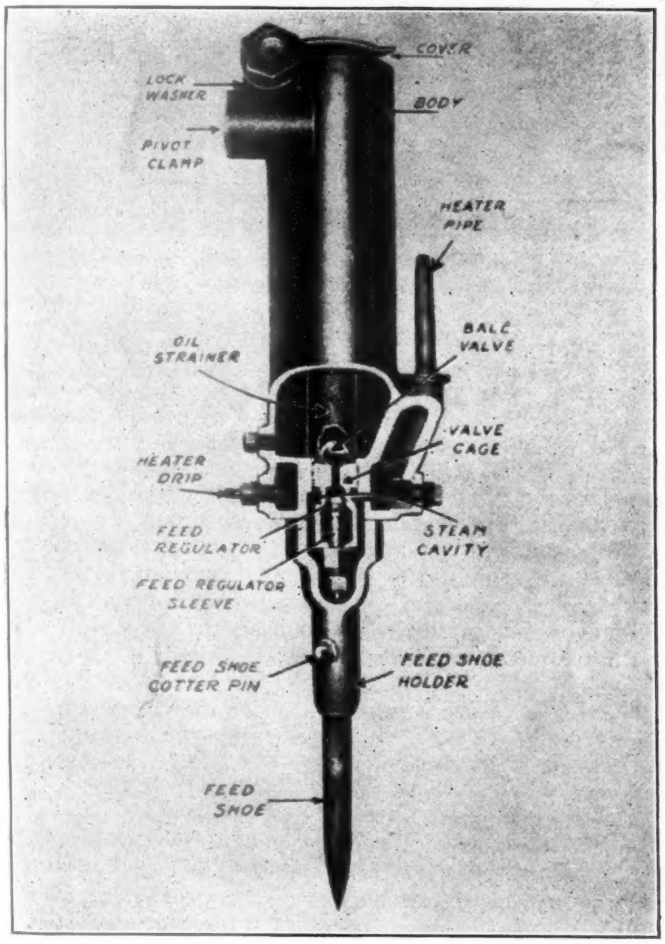
The barrel answers two purposes. It covers all working parts, leaving nothing exposed to catch the clothing or injure the operator and does not revolve while the screw is bring driven; the end of the barrel is a guide for the screw-head. It is provided with a liner for small screws.

The drivers are made in four sizes, No. 1, 11 in. long, takes screws from No. 20 down to No. 12; No. 2, 11 in. long, takes screws No. 12 and smaller; No. 3, 6 in. long, takes screws from No. 20 down to No. 12; No. 4, 6 in. long, takes screws No. 12 and smaller.

Where the operator stands over his work, a driver 11 in. long is furnished. For overhead work the 11-in. driver is furnished with an extension.

Swanson automatic flange lubricator

THE flange lubricator marketed by the United Manufacturing & Sales Corporation, Denver, Col., is automatic as to adjusting itself to the movement of the wheels and feeds oil only when the locomotive is in motion. The purpose of this device is to reduce both flange and rail wear to a minimum with the least



Construction and parts of the Swanson automatic flange lubricator

possible amount of oil. As can be seen from the accompanying illustration, it contains no regulating valve or complicated parts to get out of order readily. It is heated by the air compressor exhaust steam to insure proper flow of oil in cold weather. Any oil from clean, light crude to asphaltum can be used.

There is nothing complicated in its operation. When the locomotive or car moves, the motion of wheels causes the ball valve in the lubricator to unseat, allowing oil to flow to the auxiliary reservoir. The regulator then controls the amount of oil fed to the flange. When the locomotive stops, the ball valve automatically returns to its seat, shutting off the flow of oil. It requires no regulation by the engineman as that is attended to when the kind or grade of oil to be used is decided on and the proper sized regulator applied in the lubricator. It adjusts itself to all local conditions; the movement of wheels, regardless of how much, does not displace the feed shoe and does not effect the operation of the lubricator.

It is provided with a good strainer to prevent the possibility of dirt in the oil getting to the regulator valve. When cleaning is necessary, the feed shoe holder and valve cage is removed after which the device is blown out with steam. The feed regulator should be free in the sleeve. The lubricator should be filled at terminals whether empty or not, as more damage may be done to a flange in 100 miles without oil than in 1,000 miles with oil. Inspectors should examine the lubricator to see that the feed shoe is properly located on the flange. The pivot clamp should be loosened, the shoe moved to place and the clamp tightened again. If the heater drip and steam cavity port is not open, the 3/8-in. plug below the heater pipe should be removed and the port opened with a small wire. Care should be taken when the locomotive is jacked up, that the feed shoe does not slip by the flange.

The method of applying the flange lubricator is simple. The suspension bracket is bolted to the locomotive frame or any other suitable place so that the arm will be properly located. The lubricator body should hang as nearly perpendicular as possible. The feed shoe should be located directly in the throat of the flange. The suspension bracket arm should always be located between the wheel and the body of the lubricator. The suspension arm must be 1 1/4 in. full round iron, the bracket about 3 in. by 3/4 in.

The air compressor exhaust pipes should be tapped for the heater at a point where dry steam will be obtained. Heater pipes must be arranged so as to leave no water pockets to cause freezing. A 1/4-in. pipe should be brought down from the air compressor exhaust underneath the boiler and divided centrally between the lubricants. The steam hose which connects the pipe with the lubricator heater should be of sufficient length to insure flexibility.

Tail rod construction for gas-engine compressor

THE Worthington Pump & Machinery Corporation, New York, has developed a tail rod construction for its small four-cycle, double-acting gas-engine compressors which serves the purpose of relieving the weight of the piston on the cylinder bore and also allows greater and more effective circulation of the cooling water through the piston and rod.

The box type frame is heavily ribbed, has a full-length bearing on the foundation and is carried above the center line of power stresses to eliminate weaving. Special Diesel iron is used for the power cylinders. These are made separately and bolted to the end of the main frame. Expansion between the inner and outer cylinder walls is taken care of by an expansion ring. All water passages are large and free from complications.

Inlet and exhaust valves are located at the top and bottom of the power cylinder, thereby equalizing stresses under temperature changes. The front and rear cylinder heads are symmetrical in shape and provided with large water-cooling spaces. This construction eliminates complicated castings and insufficient water-cooling space incident to construction where valves are located in the cylinder heads. The cylinder design also allows for easy inspection and adjustment.

The power piston and rod are water cooled, the circulating water entering the piston rod through the cross-

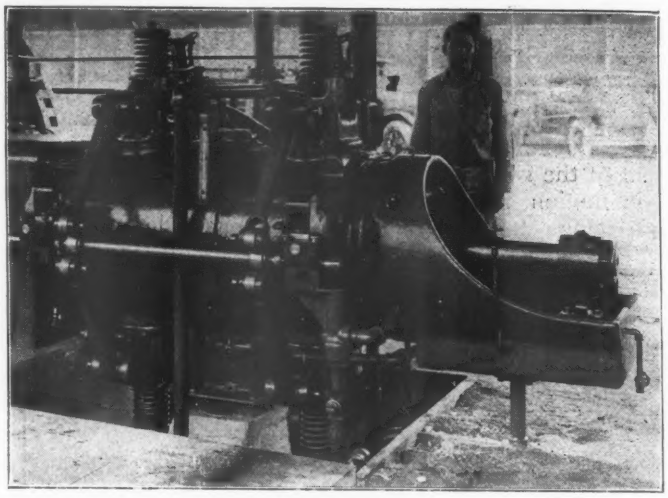
head and after circulating through the piston leaves through the tail rod. Connecting rods, shafts, crossheads, etc., are of forged, furnace-annealed steel.

A cast iron housing with hand-hole plates between the main frame and the compressor cylinder prevents the possibility of gas entering the crank case.

A belt-driven Massey governor, mounted on the side of the main frame is connected by levers to two balanced mixing valves, one for each end of each power cylinder. As an extra precaution, a safety flywheel stop short-circuits the ignition on overspeed.

Positive lubrication of the running gear is obtained by a reciprocating pump driven from the cam shaft. A forced-feed lubricator provides lubrication to the power and compressor cylinders and to the metallic packing provided on the power and compressor piston rods.

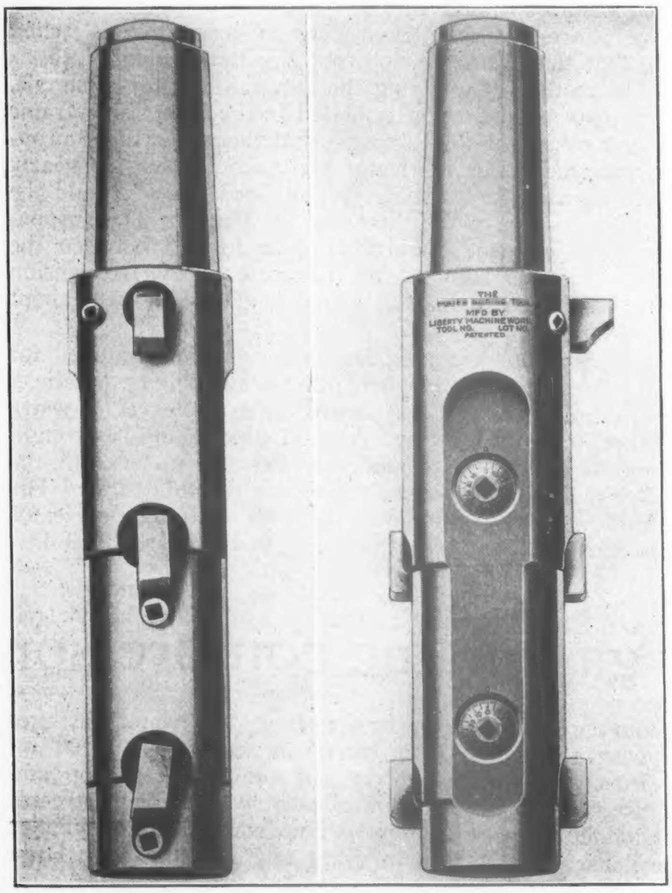
The compressor cylinders are of the Worthington feather valve type, provided with large water-cooling spaces for the cylinder and heads. Valve seats and guards for high pressure work are of hardened forged steel and for low-pressure and vacuum work, of hard cast iron.



The Worthington compressor, double-acting power cylinder with tail rod construction

Heavy duty car wheel boring tool

A CAR wheel boring tool designed for the heavy duty service strains placed on it in steady daily use has recently been placed on the market by the Liberty Machine Works, 906 North Market street, St. Louis, Mo. It has a triple arrangement of cutters, each set boring independently of the others. One set is for the rough boring operation and another for the finishing. These are so arranged that the finishing cutters engage immediately after the roughing cutters clear the work. After the finishing cut is taken, the cutter at the top of the tool chamfers the hub.



Maier car wheel boring tool provided with a wide range of cutter expension

Each pair of cutters is uniformly expanded to the desired size by means of a cam arrangement controlled by a micrometer dial graduated to thousandths, which insures close adjustments to the desired size. One of the features of the tool is the hardened cutter support, the purpose of which is to insure a rigid holder for the cutters and to prolong the life of the tool by preventing disintegration on the surfaces where the chips come in contact with the tool body.

Another advantage of these hardened cutter supports lies in the opportunity they present of setting the roughing cutters to the correct rake angle. The cutter is set at this rake instead of grinding away part of the cutters as is the general custom. There are three purposes in inclining the roughing cutters. They are to increase the life of the cutter, to decrease the tendency to heat and to permit faster feeds.

The Maier boring tool has a wide range of cutter expansion, the purpose of which is to reduce cutter costs by using more of the high speed steel on each set of cutters. The cutter locking device consists of a special screw lock which locks both cutters metal to metal. This arrangement insures uniformity of sizes and gives the rigidity of a solid bar.

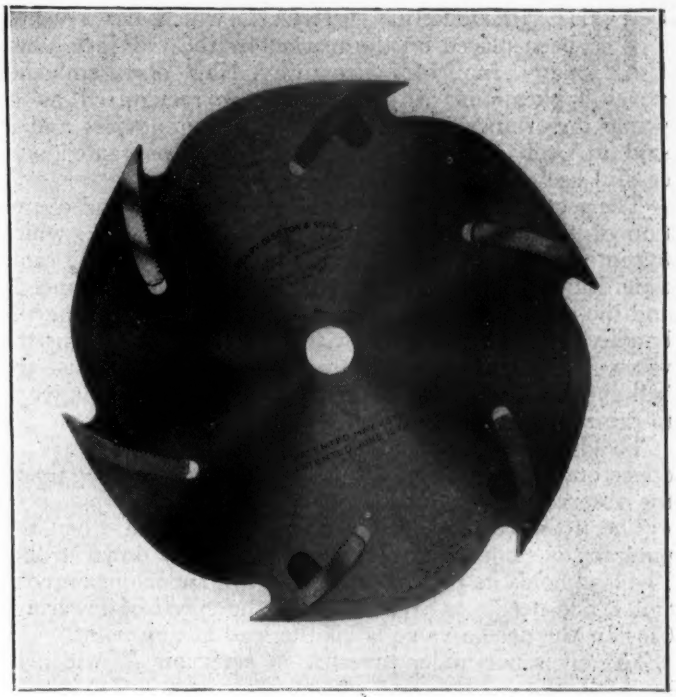
The tool is furnished in ten different sizes for boring steel, chilled or cast iron car wheels. The sizes for the former range from 3¼ in. to 4¼ in., to 6¾ in. to 9½ in. and for the latter, from 3 in. to 4¼ in., to 5¼ in. to 7¾ in.

THE FOREMEN'S SAFETY SCHOOL of the Milwaukee Association of Commerce has opened its sixth annual term with about 5,000 members registered. In the four months beginning with December 16 and ending next April, 46 meetings are to be held. About 50 volunteer speakers aid in the conduct of the school, which consists largely of lectures. These gatherings are described as miniature safety congresses. The need of such a school is indicated by the fact that in 1924 employers in the state of Wisconsin paid out for indemnities, under the workmen's compensation act, $4,200,479, the personal injuries reported in that time, fatal and nonfatal, being 22,766.

Inserted tooth saw and groover

IN the Disston Ideal saw and groover, manufactured by Henry Disston & Sons, Inc., Philadelphia, Pa., the inserted tooth principle is employed for the production of grooving, molding, beading, tenoning, etc. The teeth, of special high-speed tool steel, are locked in sockets arranged spirally in the blade. Any tooth can be inserted or removed in a moment. Teeth can be obtained with any form of cutting edge, so that by choosing the proper tooth any desired shape or size of groove or slot can be cut. This enables the user to build up a saw for his special requirements or the work in hand and to change it at will.

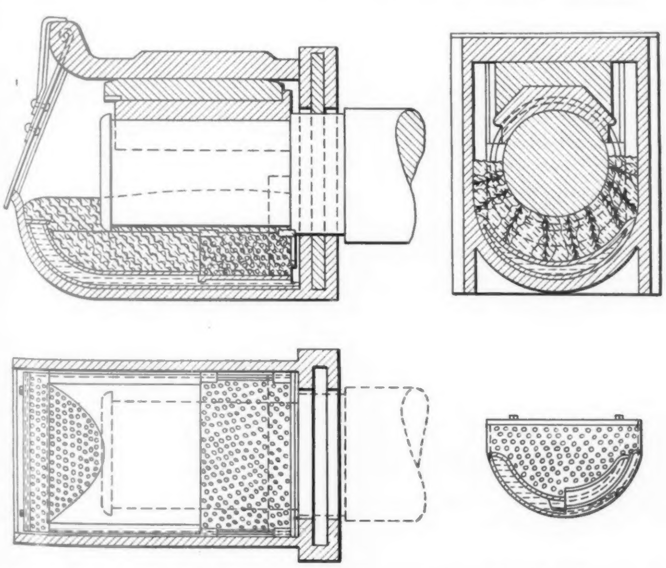
The teeth are set in the blade to provide clearance without swaging or setting. This insures that, regardless of the amount of wear, they will always cut the same width groove. Wear on the teeth is compensated for by moving them outward 1/16-in. or 1/32-in. A rack cut in the tooth fits a special lock and provides exact adjustment without troublesome measurements. With this type of saw, teeth of such hardness and toughness can be used that when sharpening is necessary, they are not filed but touched up in the saw with a whetstone or removed and sharpened on a grinding wheel. Nothing is touched but the teeth in sharpening or adjusting them. The width and clearance always remain the same. The blade never changes in diameter as it does when an old style saw is sharpened.



Wood saw with inserted teeth, adjustable for wear

Oil cup lubricator for journal boxes

THE device shown in illustration is a lubricator for journal boxes which may be inserted in any of the standard forms of journal boxes, in present use without any alterations. The object of the device is to maintain a certain amount of lubricant aside from what is already normally held by capillarity in the waste or packing, which may be fed to it for a continued effective supply of lubricant to all parts of the bearings, particularly those that are more apt to be subjected to frictional heat.



A lubricator designed to efficiently and equally distribute the lubricant for journal boxes

The lubricating device is inserted in the lower part of any standard journal box and comprises a substantially closed lubricant container. The container consists of two pieces of sheet metal formed to fit the contour of the box. The lower wall or the one that rests on the bottom of the box, extends from the lower edge of the main journal box opening to the rear of the box. The upper wall contains two perforated sheets, one extending from the edge of the main box opening down to the point where the bottom of the box becomes parallel with the axle and the other extends approximately from the middle of the journal to the rear of the box. The upper end of the lubricator is covered by a perforated hinged lid.

In practice, the lubricator may be inserted through the main opening of the journal box and located to rest on the bottom wall of the journal box and beneath the journal. In the space provided between the journal fillet and the middle of the bearing is inserted a piece of special lubricating packing of twisted formation adapted to absorb and transmit the lubricating oil from the container to any portion of the journal. The remainder of the space between the bottom of the journal and the top of the lubricator is packed with the usual cotton waste or other packing material.

The oil ordinarily is poured in the journal boxes on the cotton waste after which it flows through the perforations of the cover plate and the wall, into the body of the lubricator between the upper and lower walls. At the perforations in the top of the lubricator the oil, coming in contact with the waste and the twisted packing is absorbed and distributed to the journal.

This device has been patented by William E. Christ, 21 Kolb avenue, Belmar, Baltimore, Md.

Readily controlled oil-operated jack

THE PEDERSEN OILJAK, which has recently been placed on the market by the Oil Jack Company, Inc., 1457 Broadway, New York, embodies novel applications of principles long recognized as of prime importance in the design of lifting devices and is said to overcome difficulties which have prevented successful use of these principles in the past.

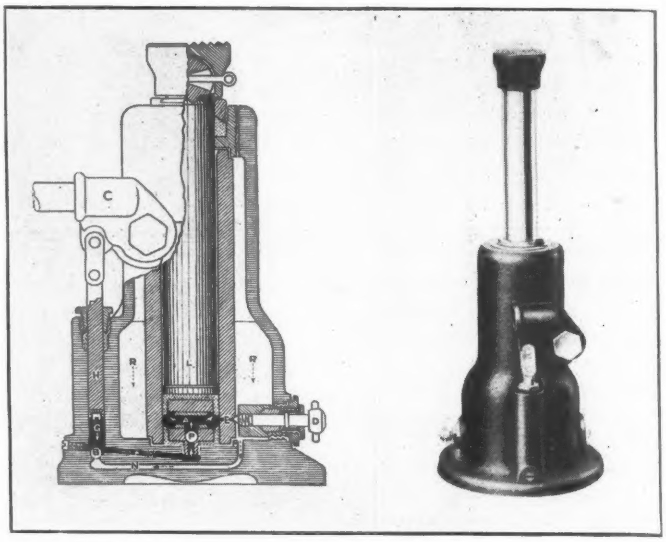
The sectional view explains the construction and operation of the jack. Raising the handle of the jack, which fits into socket *C*, raises the pump plunger *H*, at the same time drawing oil from the reservoir *R* through channel *N* and the ball check valve *B* into chamber *G*. Lowering the handle compresses the oil in the chamber *G*, seating the valve *B* and forcing oil through the channel *M* past the ball check valve *P* into chamber *A*, causing the plunger *L* to raise and lift the load.

To lower, the needle valve *D* is turned slightly. This opens outlet *E* and permits the oil to travel back again to the reservoir *R*.

The lifting of the load is always controlled when the pumping is stopped at any point of the up or down stroke. The load holds its position and is always under instant control. The needle valve *D* controls the speed of lowering. Closing the needle valve holds the load at any point.

The oil is not under pressure in reservoir *R*, which is in the main casting. Chamber *A*, where the pressure occurs, is entirely surrounded by a steel jacket, thus reducing to a minimum the possibility of leakage, expansion or breakage.

The swivel head is corrugated and hardened to insure a firm grip under a load. The ram is solid steel, 1⅜ in. in diameter, heat treated and ground. Adjustable oil-retaining packings prevent leakage. The rocker arm is rigidly constructed and provided with a positive stop. It oscillates on a heat treated fulcrum bolt and projects over the pump stem and thus protects it. The base is 6½-in.



Pederson Oiljak which can be instantly stopped, under load, at any position of the handle

in diameter and the entire casting is amply strong to support many times the rated capacity of the jack. The jack can be obtained in 1, 3, 6 and 10-ton capacities.

Redesigned combination tool grinder

THE combination drill, cutter and reamer grinder, manufactured by the Gallmeyer & Livingston Company, Grand Rapids, Mich., has been redesigned with the object of making the machine more compact and convenient to operate.

Compact, motor driven tool grinder

The compactness has been obtained by providing for a motor drive, thus eliminating overhead shafting. The motor is fully inclosed to eliminate dust. Removable hand hole covers are provided for use when making bearing adjustments, cleaning the commutator, renewing brushes, lubricating, etc.

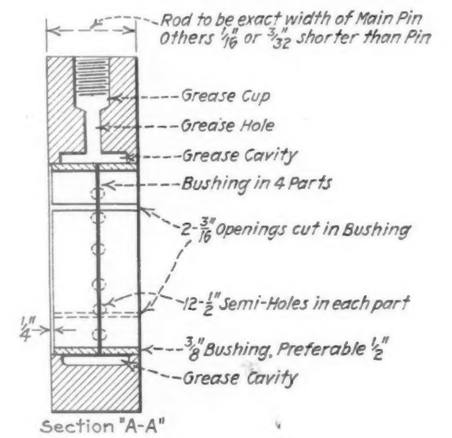
One end of the motor shaft is used for driving the cutter and reamer grinding wheel spindle. It is driven by an endless belt with the proper ratio of pulley size to provide for increased speed necessary in the case of the smaller diameter wheels used for cutter and reamer grinder work. This machine will grind either straight or taper work, as straight or cup wheels can be used.

The longitudinal, transverse and vertical features are controlled by convenient hand wheel movements. The maximum capacity of the machine is 9½ in. in diameter by 20 in. in length, with a longitudinal movement of 15 in., transverse movement of 7 in., and a vertical movement of 6¾ in.

A special motor headstock with a small lamp socket driven motor, mounted integrally with the headstock, is provided for handling cylindrical and internal grinding. The work spindle is driven by a worm, thus providing the necessary speed reduction and eliminating the necessity for an overhead drum. This feature is an advantage when grinding tools of different kinds.

Floating rod bushing requires no machining

BECAUSE of the heavy duty imposed on locomotive rod bushings, they require frequent renewal and it is desirable that the time consumed as well as the labor required in this operation, be minimized. Considerable time is involved under the present practice in the renewal of the bushings used in side rods. This

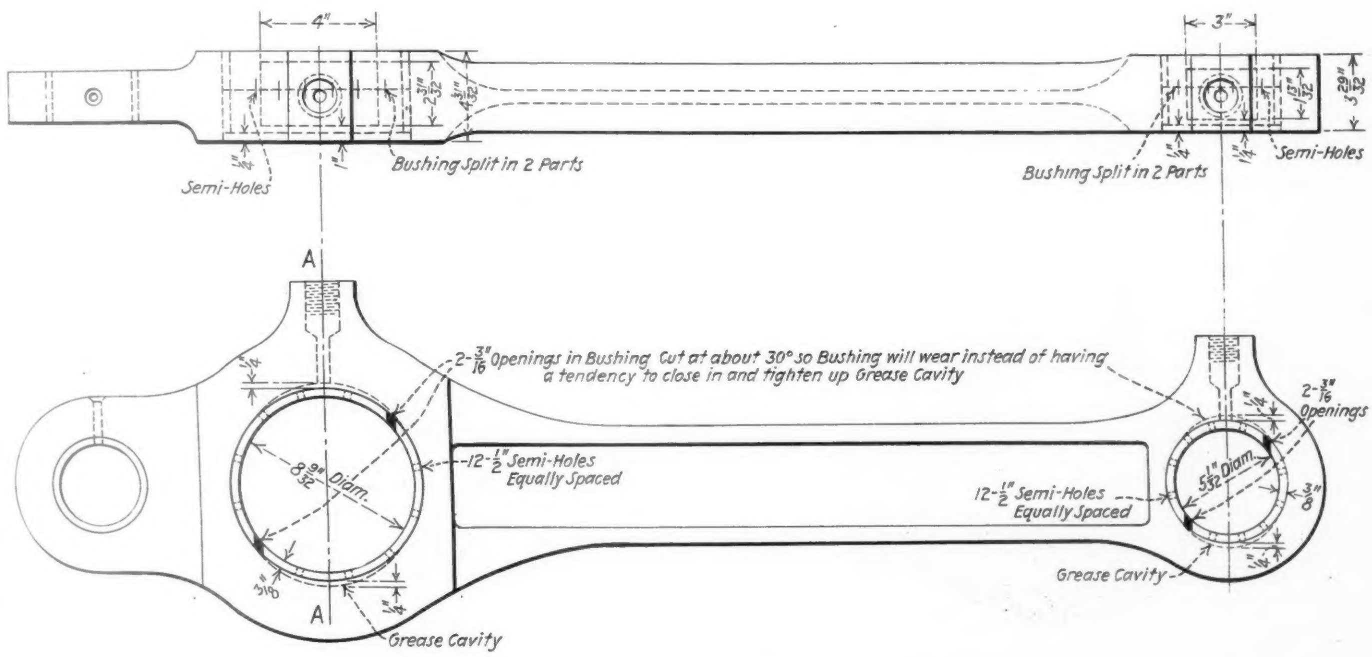


Cross-section of the bushing in the rod, showing how it is lubricated

is due principally to the fact that a considerable amount of machining is required. One object of the bushing shown in the illustration is to provide a construction which will simplify and expedite its renewal. All machine work is eliminated as well as the need for removing the side rods to provide access to the bushings or to enable made complete to the required dimensions. Hence, they are used just as they are stamped or cast without the necessity of any machine work.

The sections of the bushings may be considered as shims. After the parts which hold the rod in place have been removed the sections may be readily removed and replaced by hand. The usual practice is to fit rod bushings with extreme care in the belief that a close fit is required by reason of the heavy duty to which the bushings are subjected. These bushings float in the rod; i.e., they can move around so that the lubricant is equally distributed. On the particular application shown in the illustration, two 3/16-in. openings, cut at an angle of about 30 deg., are provided so that the bushing will wear instead of having a tendency to close in and tighten up the grease cavity located at the top and bottom of side rod.

The length of the bushing sections is somewhat less than 120 deg. which leaves between the ends of the sections sufficient space so that they will not become wedged or jammed against each other in the openings. The width of the sections is such as to provide for the usual fillet and at the same time allow for some lateral play, which is effective in the distribution of the lubricant. The inner edges of the bushing sections are provided with twelve ½-in. countersunk, equally spaced lubricant conveying and distributing notches or recesses which are of semi-circular outline. Circumferentially extending lubricant distributing channels or grooves are provided in the side rod at the top and bottom as is shown in the drawing, and are in communication with the recesses and with the division between the adjacent



Method of applying floating bushing to a side rod

the worn bushing to be removed. Further advantages claimed for this bushing are economy in the brass required, improved distribution of the lubricant to the bearing and equalized wear of the bushing.

The several bushing sections forming the complete bushing may be duplicates of one another which may be stamped from rolled brass or cast, in either case being ends of the bushing sections. The upper channel may be supplied with lubricant through a passage leading from the threaded socket of the usual grease cup.

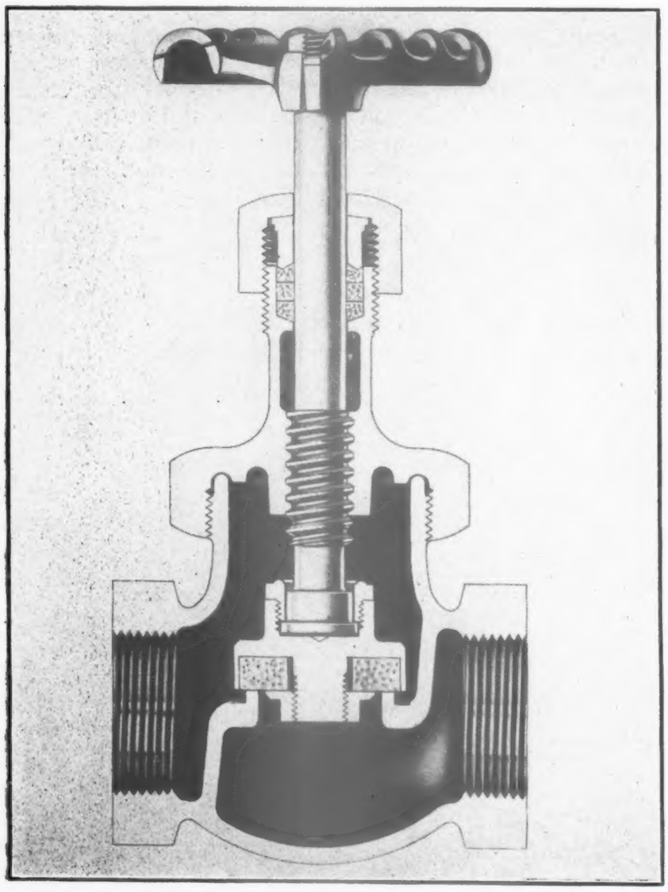
In renewing the bearing for the main crank pin, the clamping bolt is first removed from the bearing end of the connecting rod. The wedge will then come out and the rear half of the bearing block, or brass, is then

removed and the connecting rod pushed forward sufficiently to be out of the way to give free access to the bearing of the side rod on the crank pin. The side rod will be jacked up so as to relieve the bushing sections at the top from the weight of the rod as well as to provide sufficient clearance for the free movement of the bushing sections. The worn bushing sections can then easily be removed by means of a suitable tool and new bushing sections be freely pushed into place in the opening around the crank pin. With the bushing in three parts, it is easy to remove and replace. The connecting rod is then pulled back into place, the rear half of the bearing, the wedge block and bolt are replaced and the wedge driven in. This entire operation requires a comparatively short time and the locomotive is not taken out of service for renewing the bearing.

This bushing has been patented by J. E. Allen, Peru, Indiana.

Medium pressure bronze globe and angle valves

A LINE of medium pressure bronze globe and angle valves for 225 lb. working steam pressure has been placed on the market by Jenkins Brothers, New York. They have been designed to fulfill a need for a valve with



The Jenkins valve which operates under 225 lb. pressure

the renewable disc feature which will satisfactorily meet higher pressures than recommended for standard valves.

The bonnet and union are made in one piece to screw on to the outside of the body threads. This construction gives added strength to the body end. The bonnet hexagons are made especially large to provide for the easy removal of the bonnet without distortion.

The valves are regularly fitted with the Jenkins special No. 800 composition disc for high pressure work. No regrinding is necessary to insure a tight valve. The spindle is made of manganese bronze, with large, powerful threads which are all in contact when the valve is closed. The stuffing box is deep, with plenty of asbestos packing which is compressed by means of a bronze follower. A ventilated hand wheel of malleable iron is used.

The valves are furnished globe and angle with screwed or flanged ends, in sizes of ¼ in. to 3 in.

Unique fire extinguisher

A FIRE extinguisher, known as the Rego Fire Stopper, which has a number of unique features, has recently been developed by the Bastian-Blessing Company, Chicago. The first noticeable feature of this extinguisher is its appearance. The device is composed of

Position of the extinguisher when in use

two main units: a cone shaped container which is filled with dry powder and a small tank which is filled with CO_2 gas under pressure. When a fire is discovered, the device is turned up-side-down, the valve on the gas tank opened and the resulting steam of powder is directed at the base of the flame. When the fire is out, the valve is closed and the tank returned to an upright position. Only as much powder as is necessary to put out the flame is used.

The principle upon which the extinguisher is worked is that the powder in coming in contact with the flame, generates CO_2 gas and immediately blankets the entire fire and effectively smothers the flame. The use of CO_2 for power gives the device an effective range or from 25 to 30 ft. It is claimed that the extinguisher will put out all kinds of fire including those involving electric wiring. The powder is a non-conductor of electricity and can be used with safety in extinguishing electrical fires up to 160,000 volts.

News of the Month

The Missouri Pacific plans to spend $248,000 for shop buildings and $40,000 for shop machinery during 1926. Appropriations have also been made for new equipment to include the purchase of 25 locomotives, 2,000 freight cars, 22 passenger cars and 8 passenger motor cars.

Representatives of the Brotherhood of Railroad Trainmen and the Brotherhood of Locomotive Engineers have filed a petition with the Public Service Commission of Kansas asking that a limit be set on the length of freight trains, on the ground that the longer trains have increased the hazard to trainmen. A statement issued by the brotherhoods alleges that injuries to trainmen have increased nearly 50 per cent in the past four years due largely, it is claimed, to the increased length of freight trains.

Central of New Jersey locomotive repairs criticized

The Interstate Commerce Commission has issued a report as a result of its investigation of the cost of locomotive repairs of the Central of New Jersey at outside shops during the fall of 1921 and during 1922 and 1923, finding that it exceeded the cost of substantially similar work in the company's own shops, and that the greater portion of such excess cost was an "unreasonable expenditure for maintenance of equipment and not in the interest of efficient and economical management as required by section 15a of the interstate commerce act." The present report relates to 117 locomotives repaired under five contracts and as to 50 locomotives repaired by the Crucible Steel Company, the commission finds that the contract, made in March, under a cost-plus basis, in preparation for the next winter, represents "improvidence in management which should be considered when fixing rates intended to yield the standard return contemplated by law."

Fuel economy contest on D. L. & W.

James Sullivan, machinist, Kingston, Pa., enginehouse, was awarded the first prize of $100.00 for having the best paper in the fuel economy contest recently held by the Lackawanna. Second and third prizes were awarded to Floyd E. Henneforth, fireman, Scranton division, and to H. F. Shaw, fireman, Buffalo division, respectively. A total of 126 papers were submitted by eligible employees in the contest. These papers were judged by a committee of five locomotive enginemen and five firemen, representing each of the five divisions of the railroad. The contest was open to enginemen, firemen, hostlers, coal chute operators, fire cleaners and other employees engaged in the handling of locomotive fuel in and around terminals. As each paper was received, it was given a number and the identity of the author was kept secret until after the awards had been made.

The object of the contest was to stimulate interest in fuel conservation and is in line with the efforts of the management to economize in the use of fuel for locomotives. During 1924, the Lackawanna consumed nearly 2,000,000 tons of coal for locomotive fuel. The contest brought out a number of good ideas of a practical nature and also showed the employees and management how they could co-operate in the prevention of waste in the utilization of coal.

Bangor & Aroostook complains of A.R.A. rules governing compensation for destroyed cars

The Bangor & Aroostook has filed a complaint with the Interstate Commerce Commission against the American Railway Association and its member roads asserting that the rules for compensation to be paid and settlement to be made for the use of cars destroyed on the line of a railroad other than the owner of the cars, and the interpretations of such rules adopted by the A. R. A., are unjust, unreasonable, arbitrary and in violation of section 1 of the interstate commerce act. Complainant particularly objects to the rules governing compensation for rebuilt cars at rates based on depreciation from the date that the car from which the reused materials were taken originally was placed in service. The commission is asked to establish reasonable rules, retroactive to October 30, 1922, the date when protest and complaint was made to the A. R. A.

The Bangor & Aroostook, according to the complaint, has had several hundred cars rebuilt and is obliged either to withdraw from the A. R. A. and its Mechanical Division, or to accept approximately 25 per cent of the depreciated cost of the car classified as "rebuilt" under the rules; or in other words, about one-third of the amount of the lien on such car authorized by the Interstate Commerce Commission in connection with equipment trusts. At a hearing before the arbitration committee of the Mechanical Division on December 14, 1922, the complaint says, the unfairness of the rule was urged not only by the Bangor & Aroostook but by many other car owners, including the Baltimore & Ohio; Central Vermont; Delaware & Hudson; Great Northern; Northern Pacific; Lehigh Valley; Missouri Pacific; Missouri-Kansas-Texas; Chicago, Rock Island & Pacific; St. Louis Southwestern; Wabash; Seaboard Air Line; Pere Marquette; Central of New Jersey, and Atlantic Coast Line. The subject was then referred to a special committee which had made recommendations for changes in the rules satisfactory to the complainant, but, says the complaint, the recommendations have not been submitted to members of the A. R. A. for consideration.

Railway labor bill

A most unusual situation is presented to Congress in the joint recommendation of the railroads through the Association of Railway Executives and representatives of organized railway employees, of a bill to do away with the Railroad Labor Board and provide a method of adjusting labor disputes which will be mutually satisfactory. Naturally it is a compromise, but the spirit in which it has been presented augurs well for the success of the plan, provided Congress enacts it into a law. Thus far the only important criticism voiced in the hearings has been from a representative of the National Association of Manufacturers, who feels that the public interest is not fully protected.

The provisions of the bill may be summarized as follows:

First. Any and all disputes shall be first considered in conference between the parties directly interested.

Second. Adjustment boards shall be established by agreement, which shall be either between an individual carrier and its employees, or regional, or national. These adjustment boards will have jurisdiction over any disputes relating to grievances or to the interpretation or application of existing agreements, but will have no jurisdiction over changes in rates of pay, rules or working conditions. It is, however, provided that nothing in the act shall be construed to prohibit an individual carrier and its employees from agreeing upon settlement of disputes through such machinery of contract and adjustment as they may mutually establish.

Third. A Board of Mediation is created, to consist of five members appointed by the President by and with the advice and consent of the Senate, with the duty to intervene, at the request of either party, or on its own motion, in any unsettled labor dispute—whether it be a grievance or a difference as to the interpretation or application of agreements not decided in conference or by the appropriate adjustment board, or a dispute over changes in rates

of pay, rules or working conditions not adjusted in conference between the parties. If it is unable to bring about an amicable adjustment between the parties, it is required to make an effort to induce them to consent to arbitration.

Fourth. Boards of arbitration are provided for, when both parties consent to arbitrate, also the method of selecting members of the boards and the arbitration procedure. Any award made by the arbitrators shall be filed in the appropriate district court of the United States and shall become a judgment of the court, binding upon the parties.

Fifth. In the possible event that a dispute between a carrier and its employees is not settled under any of the foregoing methods, provision is made that the Board of Mediation, if in its judgment the dispute threatens to substantially interrupt interstate commerce, shall notify the President, who is thereupon authorized, in his discretion, to create a board to investigate and report to the President, within 30 days from the date of the creation of the board. It is also provided that after the creation of such a board and for 30 days after it has made its report to the President, no change, except by agreement, shall be made by the parties to the controversy in the conditions out of which the dispute arose.

Locomotives installed and retired

Month—1925	Installed during month	Aggregate tractive effort	Retired during month	Aggregate tractive effort	Owned at end of month	Aggregate tractive effort
January	167	7,455,971	213	6,242,079	64,824	2,590,525,478
February	125	6,233,494	169	5,118,878	64,779	2,591,618,849
March	138	6,249,721	170	4,888,933	64,747	2,592,979,637
April	171	7,498,252	409	13,126,135	64,509	2,587,347,354
May	147	7,930,840	172	5,329,461	64,484	2,589,912,779
June	179	9,746,100	224	8,296,659	64,435	2,591,286,720
July	139	7,208,534	170	5,602,619	64,420	2,593,971,635
August	147	8,384,262	210	5,866,368	64,357	2,596,489,549
September	129	7,981,464	229	8,601,871	64,257	2,595,729,142
October	150	7,284,850	266	7,930,271	64,142	2,595,082,839
November	112	8,862,352	394	15,659,796	63,869	2,588,576,535
Total for 11 months	1,604	....	...	....	......	....

Figures as to installations and retirements prepared by Car Service Division, A. R. A., published in form C. S. 56 A-1. Figures cover only those roads reporting to the Car Service Division. Figures of installations and retirements alike include also equipment rebuilt to an extent sufficiently so that under the accounting rules it must be retired and entered in the equipment statement as new equipment.

Passenger cars installed and retired

Quarter	No. installed during quarter	No. retired from service during quarter	No. owned or leased at end of quarter
Full year, 1924	2,824	2,376	......
1925			
January-March	609	589	54,594
April-June	690	644	54,658
July-September	664	736	54,562

Figures from Car Service Division, A. R. A. quarterly report of passenger cars, Form C. S. 55 A. Figures cover only Class I roads reporting to Car Service Division.

Labor board issues first report

The maintenance of the United States Railroad Labor Board, created on April 15, 1920, has cost $2,101,376, including the appropriation for the fiscal year ending June 30, 1926, according to a report the board has issued covering its activities. The report shows that 13,941 disputes were referred to the board from the date of its establishment to December 31, 1925, and that disposition was made of 13,447. Of this number 6,006 were local disputes. The remainder of the cases, totalling 7,935, were of a general nature, affecting large groups of railroads and their employees in any or all classes of service, and were requests for wage increases or reductions, or the general revision of rules governing working conditions.

The report covers government participation in railway labor disputes prior to the establishment of the Labor Board, including a summary of the Act of 1888, the Erdman Act of 1898, the Newlands Act of 1913, the Adamson Law, and procedure under government control. It also considers the growth of the present law and the Railroad Labor Board, describing labor conditions at the end of federal control, the labor provisions of the Transportation Act, and the activities of the bi-partisan board. In Part 3 of the report, devoted to the policy and activities of the Railroad Labor Board, it analyzes wage decisions, rule decisions, other questions considered by the board, the volume of work, the enforcement of decisions and the cost of maintenance.

Meetings and Conventions

At the annual meeting of the Cleveland Steam Railway Club, held at Hotel Cleveland, Cleveland, Ohio, January 4, 1926, the following officers were elected to serve during the coming year: President, G. L. Foster, assistant chief interchange inspector, Cleveland; first vice-president, C. Rhodes, division car foreman, Erie, Cleveland; second vice-president, R. A. Kleist, general car foreman, Baltimore & Ohio, Lorain, Ohio; secretary-treasurer, F. L. Frericks, New York Central, Cleveland.

Southeastern Car Foremen's Assn.

About 70 were in attendance at the annual meeting of the Southeastern Car Foremen's Association held at the Ansley Hotel, Atlanta, Ga., Friday, January 15. The one-day session, presided over by Livingstone Martin (B. & O.), president, was devoted to the reading and discussion of changes in M. C. B. rules. Despite the fact that orders had been placed in August or September, many complained of delays in receiving rule books, so it was decided to write to the American Railway Association to find out why rule books could not be issued earlier.

The following officers were elected: E. F. O'Connor (South-

Freight car repair situation

1925	Number freight cars on line	Cars awaiting repairs: Heavy	Light	Total	Per cent of cars awaiting repairs
January 1	2,293,487	143,962	47,017	190,979	8.3
February 1	2,305,520	139,056	47,483	186,539	8.1
March 1	2,313,092	141,192	43,855	185,047	8.0
April 1	2,315,732	143,329	43,088	186,417	8.1
May 1	2,316,561	144,047	45,467	189,514	8.2
June 1	2,320,261	146,998	48,988	195,986	8.4
July 1	2,326,734	150,530	47,938	198,468	8.5
August 1	2,335,223	153,674	43,607	197,281	8.4
September 1	2,333,849	149,705	47,473	197,178	8.4
October 1	2,335,475	139,551	40,020	179,571	7.7
November 1	2,325,086	127,680	37,801	165,481	7.1

Month	Cars repaired: Heavy	Light	Total
December, 1924	66,615	1,288,635	1,355,250
January, 1925	69,084	1,358,308	1,427,392
February	66,283	1,313,088	1,379,371
March	71,072	1,348,078	1,419,150
April	69,631	1,290,943	1,360,574
May	65,651	1,276,826	1,342,477
June	71,789	1,296,558	1,368,347
July	70,087	1,330,595	1,401,682
August	71,307	1,369,878	1,441,185
September	72,227	1,335,501	1,407,728
October	75,056	1,352,123	1,427,179

Data from Car Service Division reports.

Locomotive repair situation

Date, 1925	No. locomotives on line	No. serviceable	No. stored serviceable	No. req. classified repairs	Per cent	No. req. running repairs	Per cent	Total req. repairs	Per cent
January 1	64,384	53,118	4,849	5,927	9.2	5,339	8.3	11,266	17.5
February 1	64,308	52,994	4,220	6,143	9.6	5,171	8.0	11,314	17.6
March 1	64,255	52,851	4,988	6,217	9.7	5,187	8.0	11,404	17.7
April 1	64,230	52,619	6,241	6,345	9.9	5,266	8.2	11,611	18.1
May 1	64,034	52,933	6,697	6,082	9.5	5,019	7.8	11,101	17.3
June 1	63,976	53,074	6,618	5,916	9.2	4,986	7.8	10,902	17.0
July 1	63,942	53,025	6,600	5,832	9.1	5,085	8.0	10,917	17.1
August 1	63,921	53,263	6,313	5,740	9.0	4,918	7.7	10,658	16.7
September 1	63,812	53,261	5,902	5,514	8.6	5,037	7.9	10,551	16.5
October 1	63,701	53,058	5,337	5,552	8.7	5,091	8.0	10,643	16.7
November 1	63,604	53,371	4,450	5,387	8.5	4,846	7.6	10,233	16.7
December 1	63,368	52,643	4,656	5,370	8.5	5,355	8.4	10,725	16.9

Data from Car Service Division reports.

ern), president; W. C. Fields (Central of Georgia), 1st vice-president; C. C. Stone (Southern), 2nd vice-president, and C. W. Kimball (Southern), secretary and treasurer.

Southeastern Air Brake Club holds its first meeting

The first regular meeting of the Southeastern Air Brake Club, which was formed early in September, 1925, was held at the Piedmont Hotel, Atlanta, Ga., January 16. A general discussion followed the presentation of papers by E. F. O'Connor, air brake foreman, Southern, and M. S. Belk, general air brake instructor, Southern. The officers of the association are E. Z. Mann (Atlantic Coast Line), president; E. F. O'Connor (Southern), vice-president, and A. G. Huston (Westinghouse Air Brake Co.), treasurer.

The effect of the Diesel-electric locomotive on heavy electrification

The Metropolitan sections of the American Institute of Electrical Engineers, the American Society of Civil Engineers, the American Society of Mechanical Engineers and the American Institute of Mining and Metallurgical Engineers will hold a joint meeting in the Engineering Societies' building, 33 West Thirty-ninth street, New York, at 8 p. m. on February 18, to consider "The effect of the Diesel-electric locomotive on heavy electrification." The principal speakers will be C. H. Stein, assistant to the senior vice-president of the Central of New Jersey; Hart Cooke of the McIntosh & Seymour Corporation, and N. W. Storer of the Westinghouse Electric Company.

Western Railway Club discusses lubrication

Following a Dutch Treat dinner at the Hotel Sherman, Chicago, Monday evening, January 18, the Western Railway Club adjourned to the Crystal room and devoted the entire meeting to a discussion of the lubrication of railroad car equipment. The paper of the evening was presented by G. E. Dailey, supervisor of lubrication of the Chicago, Burlington & Quincy, who went into the matter in considerable detail and gave the members many intensely practical suggestions based on his investigation and study of lubricating methods as actually followed in freight yards, engine terminals and on the road. The most important point brought out by Mr. Dailey was the need for a well-trained force of oilers or packers which should not be considered non-productive, or in the class of common laborers, since, if their work is done well, fewer car men will be required on the repair track to change wheels set out on account of cut journals. It was brought out in the discussion that higher rates of pay than now generally given to oilers and packers are necessary in order to attract a somewhat higher grade of men to this work and make them willing to stay on the job, once they have learned the details.

Annual meeting of Central Railway Club

The thirty-seventh annual dinner of the Central Railway Club was held at the Hotel Statler, Buffalo, N. Y., Thursday evening, January 14. As indicated at the annual meeting of the club, which was held during the afternoon, the membership has grown rapidly during the past year and is now in the neighborhood of 1,650.

There were about 1,200 guests at the dinner in the evening, more than 80 of whom went to Buffalo from New York on a special train over the Delaware, Lackawanna & Western. Charles C. Pierce, of the General Electric Company, Boston, Mass., was toastmaster, and addresses were made by John M. Davis, president of the Delaware, Lackawanna & Western; E. T. Whiter, vice-president and general manager of the Central Region, Pennsylvania Railroad; and Rev. Henry A. Mooney.

At the business meeting in the afternoon announcement was made of the election of the following officers: President, A. E. Calkins, superintendent rolling stock, New York Central; vice-presidents, F. M. Barker, superintendent, Lehigh Valley; R. E. Woodruff, superintendent, Erie Railroad; and E. F. Ryan, terminal superintendent, Buffalo, Rochester & Pittsburgh.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs.

AIR BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City. Next convention May 4 to 7 inclusive, Hotel Roosevelt, New Orleans, La.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. Borcherdt, 202 North Hamlin Ave., Chicago.

AMERICAN RAILWAY ASSOCIATION, DIVISION V.—MECHANICAL—V. R. Hawthorne, 431 South Dearborn St., Chicago. Next meeting June 9-16, inclusive, Young's Million Dollar Pier, Atlantic City, N. J.

DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago. Next meeting September 21-23.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York. Next meeting, June 9, 10 and 11, in the Vernon Room of the Haddon Hall Hotel in Atlantic City.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet Ave., Chicago. Annual convention September 1-3, Hotel Sherman, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, Marion B. Richardson, 30 Church St., New York.

AMERICAN SCIETY FOR STEEL TREATING.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa. Annual meeting June 21-25, Atlantic City.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

CANADIAN RAILWAY CLUB.—C. R. Crook, 129 Charron St., Montreal, Que. Regular meetings second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que. Next meeting February 9. A paper on Autobus Competition by R. A. C. Henry, director, Bureau of Economics, Canadian National.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Meeting second Monday in month, except June, July and August, Great Northern Hotel, Chicago, Ill.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—R. E. Giger, 721 North 23rd St., E. St. Louis, Ill. Meetings, first Tuesday in month, except June, July and August, at the American Hotel Annex, St. Louis.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 514 East Eighth St., Los Angeles, Cal. Meeting second Friday of each month in the Pacific Electric Club Building, Los Angeles, Cal.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York, N. Y. Regular meetings, second Thursday each month, except June, July and August. Hotel Statler, Buffalo, N. Y. Next meeting February 11. Younger men's night. The following papers will be presented: Interchange inspection and methods to assist same, by J. M. Getzen, assistant chief interchange inspector, Buffalo; Importance of station Accounting and its Relation to the Efficient Operation of a Railroad, by John J. Jones, chief clerk to agent, Nickel Plate, Buffalo; Signal Maintenance, by E. F. Hood, assistant chief signal supervisor, N. Y. C., Buffalo; My Experience in the Mechanical Department, by Tallman Ladd, assistant enginehouse foreman, Pennsylvania railroad, Oil City, Pa.; Divisional Car Distribution, by John Xortner, car distributor, Erie, Buffalo, and Emergency First Aid Treatment by Employes, by Raymond Mitchell, clerk, trainmaster's office, Lehigh Valley, Buffalo. Entertainment by local talent.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—A. S. Sternberg, Belt Railway, Clearing Station, Chicago.

CINCINNATI RAILWAY CLUB.—W. C. Cooder, Union Central Building, Cincinnati, Ohio. Meetings, second Tuesday, February, May, September and November. Next meeting, February 11. A paper on electricity as applied to railroads will be presented by A. J. Manson, manager heavy traction railway department.

CLEVELAND STEAM RAILWAY CLUB.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meetings first Monday each month except July, August and September, at Hotel Cleveland, Public Square, Cleveland.

INTERNATIONAL RAILROAD MASTER BLACKSMITH'S ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich. Next convention August 17-19, Hotel Winton, Cleveland, Ohio.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. B. Hutchison, 1809 Capitol Ave., Omaha, Neb. Next meeting May 11-14, 1926, Hotel Sherman, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash Ave., Winona, Minn.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York. Next meeting May 25-28, 1926, Hotel Statler, Buffalo, N. Y.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in month, except June, July, August and September. Copley-Plaza Hotel, Boston, Mass. Next meeting February 9. A paper on the International Railway Congress will be presented by Julius H. Parmelee, director, Bureau of Railway Economics.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Meeting third Friday in each month, except June, July and August, at 29 West Thirty-ninth St., New York.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—George A. J. Hochgreb, 625 Brisbane Building, Buffalo, N. Y. Regular meetings, January, March, May, September and October.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

RAILWAY CLUB OF GREENVILLE.—F. D. Castor, clerk, maintenance of way department, Bessemer & Lake Erie, Greenville, Pa. Meeting last Friday of each month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Fort Pitt Hotel, Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

SOUTHEASTERN CARMEN'S INTERCHANGE ASSOCIATION.—J. E. Rubley, Southern Railway shops, Atlanta, Ga.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio. Annual meeting September 14-17, Hotel Sherman, Chicago.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, 226 W. Jackson Blvd., Chicago. Regular meetings, third Monday in each month, except June, July and August. Next meeting February 15. A paper will be presented by W. H. Finley.

Supply Trade Notes

W. W. Sayers, chief engineer of the Philadelphia plant of the Link-Belt Company, has been appointed chief engineer of the company, with headquarters at Chicago.

The Harnischfeger Sales Corporation, Milwaukee, Wis., has moved its Birmingham, Ala., office from 431 First National Bank building to 401 Pioneer building.

The Tool Steel Gear & Pinion Company, Cincinnati, O., has moved its Chicago district office to Room 648 McCormick building. Walter H. Evans is district representative.

G. T. Aitken, formerly sales manager of the Vonnegut Machinery Company, Indianapolis, Ind., has become associated with the Indianapolis plant of Fairbanks, Morse & Co.

G. L. Hulben has been added to the sales force of the Chicago branch of the Ludlum Steel Company. The general offices and works of this company are at Watervliet, N. Y.

J. I. Byrne, formerly chief engineer of the Texas Carnegie Steel Association, Galveston, Tex., has been appointed general manager of the Orange Car & Steel Company, Orange, Tex.

Andrew F. McCoole, with office at 2091-2092 Railway Exchange building, St. Louis, Mo., has been appointed railway representative in that territory of the Murphy Varnish Company, Newark, N. J.

The Okonite Company, Passaic, N. J., and The Okonite-Callender Cable Co., Inc., have opened a new branch office in the Hoge building, corner Second avenue and Cherry street, Seattle, Wash.

R. M. Chissom, special representative of the Lehon Company, with headquarters in Chicago, has resigned to become manager of railway sales of the Otley Paint Manufacturing Company, Chicago.

F. C. Horner has been appointed assistant to the vice-president of the General Motors Corporation, New York, in charge of development of the commercial motor vehicle field on steam and electric railways.

The F. F. Barber Machinery Company, Ltd., Foy building, 32 Front street, West Toronto, Ontario, will in future represent the Geometric Tool Company, New Haven, Conn., exclusively in the province of Ontario.

M. J. Miller has been appointed sales engineer in charge of the Detroit district of the Diamond Power Specialty Corporation, Detroit, Mich. Mr. Miller was in charge of the Philadelphia district for several years.

W. O. Jacquette, eastern sales manager of the Pullman Car & Manufacturing Corporation at New York, in order to take a much needed rest has tendered his resignation, to take effect on the appointment of his successor.

The National Lock Washer Company has changed its Chicago address from 1535 Lytton building to 1103 Straus building. J. Howard Horn, sales manager of the company at Newark, N. J., has been elected general sales manager.

George N. DeGuire, formerly manager, department of equipment of the United States Railroad Administration, has been appointed assistant to the president of the Locomotive Firebox Company, with headquarters at Chicago.

Frank C. Webb, representative of the Railroad Supply Company, Chicago, with headquarters at Denver, Colo., and at one time a division superintendent on the Colorado & Southern and on the Great Northern, died at Denver on January 12.

The Erie Foundry Company, Erie, Pa., has opened the following district sales offices: At 1120 Myrtle Ave., Plainfield, N. J., in charge of H. Terhune; 549 Washington Blvd., Chicago, in charge of L. F. Carlton, and 408 Donovan building, Detroit, Mich., in charge of R. B. McDonald.

J. H. Redhead, formerly assistant to vice-president and assistant manager of sales of the National Malleable & Steel Castings Company, Cleveland, Ohio, has been elected vice-president and general manager of the Columbus Malleable Iron Company, with headquarters at Columbus.

George H. Charls, vice-president and general manager of the United Alloy Steel Corporation, Canton, O., has been elected president, to succeed E. A. Langenbach, who has been elected chairman of the board. L. G. Pritz, vice-president in charge of operations, will succeed Mr. Charls.

The Mechanical Manufacturing Company, Chicago, has opened an office at 323-E Hudson Terminal building, 30 Church street, New York. J. A. Keating, representative, with headquarters at Chicago, will be in charge. H. E. Johnson, representative at Chicago, has been transferred to the eastern office.

The Southern Wheel Company, Pittsburgh, Pa., has opened a new office in the Munsey building, Washington, D. C., in charge of S. C. Watkins, special representative, who was formerly located at Atlanta, Ga. The Atlanta office in the Candler building is now in charge of C. C. Cox, representative.

William B. Albright, a director of the Sherwin-Williams Company, Cleveland, Ohio, died suddenly on December 28 while visiting in Cleveland. He was born in Philadelphia, Pa., on July 17, 1855, and has been connected with the Sherwin-Williams Company since January, 1885, serving as a director since 1894.

The Nazel Engineering & Machine Works, Philadelphia, has purchased from the T. C. Dill Machine Company all rights and titles to the Dill slotter and will manufacture it in connection with the Nazel air hammer. Robert Miller, long associated with the Dill Company as superintendent, will join the Nazel organization.

The Earle Gear & Machine Company, Philadelphia, Pa., has transferred its designs, patterns, patents and good will covering the Earle centrifugal pump to the Aldrich Pump Company, Allentown, Pa. The Earle Company will, however, continue the manufacture and sale of its line of cut gears, movable bridge operating machinery, cold metal saws and other special equipment.

F. O. Paul has been appointed service manager of the automotive car division of the J. G. Brill Company, Philadelphia, Pa. For several years Mr. Paul was connected with the sales and service departments of the Timken Roller Bearing Company, Canton, Ohio, and was previously affiliated with the International Motor Company as chief inspector at its New Brunswick, N. J., plant.

James H. Watters has been appointed assistant to the president in charge of sales of the New York Air Brake Company, New York. K. E. Keiling, who has served for some time in the office of the purchasing agent of the New York Central, has been appointed purchasing agent of the company, with headquarters at New York, succeeding W. R. Brown. B. J. Minnier, vice-president in charge of production at Watertown, N. Y., has resigned.

The Stuebing Truck Company, of Cincinnati, Ohio, and the Cowan Truck Company, of Holyoke, Mass., manufacturers of lift trucks, were merged recently under the name of the Stuebing-Cowan Company. While the directing headquarters of the new company will be at Cincinnati, Ohio, the Cowan truck division will continue its operation at Holyoke, Mass. Sales offices will be maintained in all of the principal cities with stocks located at convenient points to provide prompt service.

K. D. McKoll has been appointed Canadian district manager of the United States Electrical Tool Company, with headquarters at Toronto, Ont., and Ralph E. Bell has been appointed district manager for New England, with headquarters at Boston, Mass. The American Equipment Company of Detroit, Mich., will handle the sale of U. S. electrical drills, grinders and polishers for Metropolitan Detroit. Selling arrangements with the Backmeier Sales Corporation, Cincinnati, Ohio, have been withdrawn, the United States Electrical Tool Company having arranged to travel its own salesmen in the southern states.

Frank Purnell has been appointed assistant president of the Youngstown Sheet & Tube Company, Youngstown, Ohio, and will be in charge of the company's affairs in the absence of the president. Lewis E. Wallace, assistant district sales manager at Cleveland, has been appointed manager of the Detroit office, succeeding G. W. Bostwick, resigned. During the war Mr. Purnell was connected with the steel section of the War Industries Board

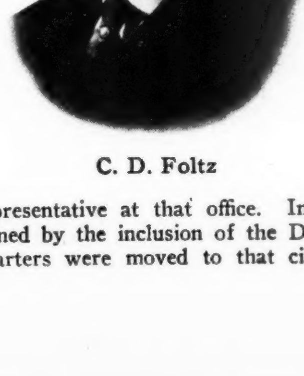
in Washington and after the war became vice-president of the Consolidated Steel Corporation, New York. Later he was made vice-president of the Bethlehem Steel Corporation in charge of its export trade and in 1923 re-entered the employ of the Youngstown Sheet & Tube Company.

Charles Albert Gould, founder of the Gould Coupler Company and the Gould Storage Battery Company, died on January 6 at his home in New York City. Mr. Gould was a pioneer in the development of automatic car couplers, electric train lighting, vestibule passenger cars and other railroad devices. He was born in Batavia, N. Y., on January 13, 1849. He became an accountant in Buffalo about 1869 and subsequently served as postmaster of Buffalo and collector of customs. About 1880 he organized and became president of Gould & Stimson, and in 1890 this was developed into the Gould Coupler Company. He remained at the head of this organization until January 1, 1925, when he disposed of his interest in the business to serve as president of the Gould Realty Company and the Gould Securities Company.

Charles A. Gould

The Sheffield Steel Corporation, Kansas City, Mo., has been organized to acquire all of the stock of the Kansas City Bolt & Nut Company and to take over all the property of the latter company consisting of four units located at Kansas City which include the Sheffield steel mills; a bar iron and rail re-rolling mill; bolt, nut and forgings plant; blue annealed steel sheet mill and an additional open hearth furnace now under construction. W. L. Allen, who was president of the Kansas City Bolt & Nut Company, is president of the Sheffield Steel Corporation and the other officers are: R. L. Gray, vice-president; L. L. Middleton, secretary; H. R. Warren, treasurer; Ernest Baxter, general manager of sales; J. C. Shepherd, assistant general manager of sales, and J. W. Anderson, assistant general manager of sales. W. L. Allen, president, recently acquired a controlling interest in the Kansas City Bolt & Nut Company, and through the new corporation has now acquired practically all of its common stock.

C. D. Foltz, representative of the Westinghouse Air Brake Company in charge of the Denver and Salt Lake City offices, has been appointed assistant western manager of the company, with headquarters at Chicago. Mr. Foltz has been connected with the railroad business for many years. At the age of fifteen he served as a telegraph operator of the Wabash. He then served consecutively as a fireman of the Chicago, Milwaukee & St. Paul; as an engineman of the Union Pacific, Denver & Gulf; engineman of the Atchison, Topeka & Santa Fe, and traveling engineer. He entered the employ of the Westinghouse Air Brake Company in 1910 as an inspec- at Salt Lake City, Utah, and was later promoted to mechanical expert and representative at that office. In 1923 his field of activity was widened by the inclusion of the Denver, Colo., office, and his headquarters were moved to that city.



C. D. Foltz

American Company Incorporated to manufacture and sell Holzwarth gas and oil turbines

The Holzwarth Gas Turbine Company of America, recently incorporated in Delaware, has acquired the patents and rights to manufacture and sell in the United States and Canada the Holzwarth gas and oil turbines which have been developed and built by Thyssen & Company, Mulheim-Ruhr, Germany, and which possess thermal efficiencies comparable with existing prime movers.

Hans Holzwarth, inventor of the turbine and former chief engineer of the Thyssen Works, is vice-president and engineering director of the American company. The offices of the American company are located at 504 Standard Oil building, San Francisco, Cal., and its European address is care of Thyssen & Company, Mulheim-Ruhr, Germany.

The American company has negotiated certain contracts with the Thyssen firm in Germany and prolonged tests under commercial conditions are to be run on a 5,000 kilowatt gas turbine and small oil turbine at the Thyssen Works in the near future. Invitations to witness these tests have been extended by the American company to a number of engineers, manufacturers and power-producers in the United States and in other countries.

Car builders rewarded for suggestions

Under the plan of employee representation in the shops of the Pullman Car & Manufacturing Corporation, awards have been made to individuals for suggestions for improvements found worthy of adoption. In the central toolroom an employee suggested a device for reclaiming sockets for drills, a device for re-bushing air hammer cylinders, and a device for holding broken drills, permitting their further use. The suggestions of an employee in the cabinet department for a device for holding drills that have been broken, permitting their further use, was also adopted. In the passenger steel erecting department an award was made for the suggestion that outside body end sheet, step riser channel, door header and platform plates be applied while the underframe is lined up for riveting in the passenger steel erecting department. An award was made in the steel cabinet department for an improved method of assembling section partitions. Other suggestions which were adopted included a device for an improved dust cap for electric reamers, a modification in double berth latch bolt manufacture, the suggestion that the cold chisel be rounded off half oval for use in cutting off screws on partitions and a suggestion for the use of two whistle valves of the poppet type in place of a three-way valve on overhead reamers.

Plans for Merger of equipment builders

The J. G. Brill Company, Philadelphia, Pa., for years engaged in the construction of street railway equipment, is one of the principal figures in a combination of transportation equipment builders announced by President Samuel M. Curwen. The combination involves companies having total assets of $150,000,000 and outstanding capital stock issues of nearly $75,000,000, with the American Car and Foundry Company, of New Jersey, the dominating factor.

Under some designation preserving the name Brill, which has been associated with Philadelphia manufacturing history since 1869, a new corporation will be organized in Delaware to take over a majority of the outstanding stock of the Brill Company and the American Car & Foundry Motors Company, a Delaware corporation, recently organized. The latter corporation owns all the capital stock of the Hall-Scott Motor Car Company, of California, and more than 90 per cent of the capital stock of the Fageol Motors Company, of Ohio. The American Car & Foundry Company, of New Jersey, manufacturers of railroad equipment, will own a majority of the voting stock of the new corporation.

The Hall-Scott Motor Car Company manufactures gasoline motors used in motorbuses, trucks, marine equipment and airplanes. The Fageol Motors Company manufactures the Fageol bus. The American Car & Foundry Company, of New Jersey, represents a consolidation of eighteen companies engaged in the manufacture and sale of railway passenger and freight train cars for domestic and foreign service, and the manufacture of steel and iron parts. It has plants at various places in the United States. In addition to being a large builder of street and elevated railway passenger equipment and car trucks, the Brill Company also has engaged in recent years in the building of engines and motorbuses and gasoline and gasoline-electric passenger cars for the steam railroads.

Trade Publications

Silent chain drivers.—A line drawing showing the "Renold" segmental bearing is contained in the four-page folder issued by the Boston Gear Works Sales Company, New York.

Air compressors.—The construction details and operating characteristics of single-stage centrifugal air compressors are given in a four-page, illustrated folder issued by the General Electric Company, Schenectady, N. Y.

Gold's vapor system.—Bulletin No. 29 covering Gold's vapor system, with colored inserts showing application to the various types of passenger train cars, has been issued by the Gold Car Heating & Lighting Company, Brooklyn, N. Y.

Washfountains.—Five types of washfountains for collective and individual use in office buildings, industrial plants, clubs and other large institutions are illustrated and described in the pages of an attractive 28-page catalogue issued by the Bradley Washfountain Company, Milwaukee, Wis.

Safety valves.—"The High Pressure Steam Testing Laboratory of Manning, Maxwell & Moore, Inc.," is the title of a catalogue issued by Manning, Maxwell & Moore, Inc., New York, illustrating the use of Consolidated safety valves on the large 1,200-lb. boiler recently installed and put into operation at its Consolidated Safety Valve Company Works in Bridgeport, Conn.

Wrought iron pipe.—The A. M. Byers Company, Pittsburgh, Pa., has a new four-reel Pathé production entitled "The Little Red Ball," which may be secured by organizations generally interested in the manufacture of wrought iron pipe. This film shows hand puddling of genuine wrought iron, including diagrammatic views of the interior of a puddling furnace, the drawing of the "Little Red Ball," squeezing, rolling of muck bar, cutting, piling, reheating, rolling, etc. The methods of forming and welding flat strips of skelp into pipe are explained by animated drawings.

Bus Power—This is a 63 page book which is presented by the Continental Motors Corporation, Detroit, Mich., in an endeavor to familiarize mechanical men with some of the main factors involved in gasoline power for motor buses. Chapters are devoted to a study of conditions to be taken into consideration in the selection of a bus power plant for operation in a particular locality, and the advantages of certain types of motors are discussed in relation to their adaptability to this class of work and to economical operation. Other chapters are devoted to the importance of proper maintenance, the provisions necessary to obtain best maintenance results, and a discussion of the qualifications of men who handle busses with particular reference to their responsibility as regards the power plant.

Heald anniversary.—A 30-page brochure, commemorating its one hundredth anniversary, has been issued by the Heald Machine Company, Worcester, Mass. The cover design of this booklet, which is entitled "The first ledger," is a replica of the old original ledger, the first pages of which bear the date of January 7, 1826. In its earliest days, the Heald business was a machine jobbing shop, and later a woodworking machinery shop. In 1890, after the death of Stephen Heald, the company became interested in the manufacture of grinding machines and has since added to its line of tools the drill grinder, the center grinder, the surface grinder, the cylinder grinder, internal grinders and miscellaneous grinding attachments. A number of illustrations show the first and latest models of these machines.

"Certificates of Mechanic" will be issued by the Chicago, Rock Island & Pacific to all its shop apprentices who have completed their four-year apprentice course in Rock Island shops. These certificates will bear the name of the graduate apprentice, the number of years he has served and the place of his employment, and will be signed by the superintendent of motive power and the master mechanic of the shop where the apprentice completed his course. The certificates will be engraved and appropriately decorated.

Personal Mention

General

Carl B. Smith has been appointed assistant to the mechanical superintendent Boston & Maine with headquarters located at Boston, Mass.

W. R. Meeder has been appointed superintendent of motive power of the Missouri & North Arkansas, with headquarters at Harrison, Ark.

The title of C. H. Terrell, assistant superintendent of motive power of the Chesapeake & Ohio, has been changed to assistant to the chief mechanical officer.

E. P. Moses, general equipment inspector of rolling stock of the New York Central, has been appointed engineer of rolling stock with headquarters at New York, succeeding P. W. Kiefer.

P. W. Kiefer has been appointed chief engineer of motive power and rolling stock of the New York Central, succeeding F. H. Hardin, with headquarters at New York. He entered railway service as an apprentice in the mechanical department of the Lake Shore & Michigan Southern (now a part of the New York Central) and in 1916 entered the equipment engineering department. He then served as locomotive designer and as leading draftsman and later worked on dynamometer car tests. In July, 1920, he was promoted from the position of chief draftsman on locomotives in the equipment engineering department to the position of assistant engineer in the office of the engineer of rolling stock. In March, 1923, Mr. Kiefer was promoted to assistant engineer of rolling stock and in May, 1924, he was promoted to engineer of motive power of the Lines East and West. In January, 1925, he was promoted to engineer of rolling stock, which position he held until his recent appointment as chief engineer of motive power and rolling stock.

Master Mechanics and Road Foremen

Irving C. Blodgett has been appointed road foreman of engines of the Boston & Maine, with headquarters located at Boston, Mass.

W. F. Shelly has been appointed road foreman of engines of the Jacksonville district of the Atlantic Coast Line, with headquarters at Sanford, Fla.

P. H. Milton has been appointed road foreman of engines of the Gainesville district of the Atlantic Coast Line, with headquarters at High Springs, Fla.

Shop and Enginehouse

R. J. Bursey, air and rod gang foreman of the Chesapeake & Ohio at Clifton Forge, Va., has been promoted to assistant general foreman.

F. G. Hutchinson, lead man in the boiler shop of the Atlantic Coast Line at Waycross, Ga., has been promoted to gang foreman, in charge of all tender repairs, including the repair of frames and trucks.

Car Department

R. S. Dickerson, assistant gang foreman of the car department of the Chesapeake & Ohio at Fulton, Va., has been promoted to gang foreman.

Earl Bendle, gang foreman in the car department of the Chesapeake & Ohio, has been promoted to lubrication inspector, working from Handley, W. Va., east.

Obituary

H. B. Henry, assistant to the general purchasing agent of the Southern Pacific, with headquarters at San Francisco, Cal., died on December 21. Mr. Henry had been in the service of the company for about 30 years.